# 目錄

## **大會歡迎詞** WELCOME MESSAGE

各位與會貴賓 您好：

中華民國生醫材料及藥物制放學會至今已成立20餘年，本學會志在推動台灣生醫材料及醫藥相關的研發，進而做為產官學相關資源合作的平台，同時可以藉由本學會來參與國際生醫材料科學與工程學會聯盟(IUSBSE)及所舉辦的世界生醫材料大會(WBC)、藥物控制釋放學會(CRS)、亞洲生醫材料大會聯盟與組織工程再生醫學國際學會(TERMIS)等四大國際學術組織，提供學者參與國外的會議以及相關生醫學術醫療的資訊及研究交流，進而促進我國生醫材料及藥物制放的研究水準。

2024年『**中華民國生醫材料及藥物制放學會年會暨國際創新藥物制放研討會**』於今年**8月15~16日**於**清華大學化學工程學系館**舉行，本次研討會涵蓋生醫材料及藥物傳輸相關應用，包括生物材料分析檢測、免疫治療、奈米藥物載體傳輸、精準醫療、醫學影像、組織工程、生醫感測、臨床實驗結果、產學論壇、商業合作契機等主題。邀請來自產、學、研界350-400人將參與此研討會並分享創新技術、臨床研發及策略決定等心得。希望藉由最新研發資訊交流，可推動我國創新生醫材料與藥物傳輸技術，開發更優異的成果，邁入商業化與國際化，並增加產品成功上市機會。

為了培植及鼓勵國內年輕生醫材料及藥物制放領域的研究人員，年會同時舉辦『**李昭仁教授生醫工程發展基金會之年輕學者獎、中華民國生醫材料及藥物制放學會年輕學者獎、與碩博士級學生的口頭/海報論競賽』選拔**。獲獎之年輕學者，經學會經費核可通過後，將有機會獲得補助參加國外會議的經費。

本次與**國際創新藥物制放研討會IADDS**合併舉辦，盛況可期。學會在此誠摯邀請各位會員及學者朋友，能踴躍出席參加，並同時邀約其他相關的好友一同參與盛會。您的參與不僅可以持續擴大本學會相關學術及研發，同時對於本學會也是莫大的榮幸。

祝福大家

平安、健康

中華民國生醫材料及藥物制放學會理事長 賴瑞陽
大會主席 國立清華大學講座教授 胡育誠
IADDS 主席 工研院生醫所副所長 呂瑞梅
IADDS 主席 清華大學特聘講座教授 宋信文
大會副主席 國立清華大學教授 李亦淇
大會副主席 工研院生醫所 林美薇

# 中華民國生醫材料及藥物制放學會年會暨國際創新藥物制放研討會籌辦委員會

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| 林美薇 | 工業技術研究院生醫與醫材研究所 |

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| 王麗芳 | 高雄醫學大學醫藥暨應用化學系 |
| 楊台鴻 | 國立台灣大學醫學工程學系 |
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| 陳三元 | 國立陽明交通大學材料科學與工程學系 |

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| 陳韻晶 | 國立清華大學生物醫學工程研究所 |
| 王子威 | 國立清華大學材料科學工程學系 |
| 萬德輝 | 國立清華大學生物醫學工程研究所 |
| 張建文 | 國立清華大學生醫工程與環境科學系 |
| 李亦宸 | 逢甲大學化學工程學系 |

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| 方旭偉 | 國立台北科技大學化學工程與生物科技系 |
| 姚少凌 | 國立成功大學化學工程學系 |
| 鄭平福 | 工業技術研究院生醫與醫材研究所 |
| 林谷峰 | 工業技術研究院生醫與醫材研究所 |

## 大會資訊 GENERAL INFORMATION

日期：2024 年 8 月 15 日至 16 日

會議場地：清華大學

主辦單位：

中華民國生醫材料及藥物制放學會

中華民國生醫材料及藥物制放學會

CRS Controlled Release Society

CRS Taiwan Local Chapter

國立清華大學 化學工程學系 National Tsing Hua University Department of Chemical Engineering

國立清華大學化學工程學系

工業技術研究院 Industrial Technology Research Institute

工業技術研究院生醫與醫材研究所

指導單位：

NSTC 國家科學及技術委員會 National Science and Technology Council

中華民國國家科學及技術委員會

國科會工程處醫工學門

國科會工程處化工學門

國科會生科處工程醫學學門

DOIT 經濟部產業技術司 Department of Industrial Technology, MOEA

經濟部產業技術司

協辦單位：

國家衛生研究院

國立清華大學工學院

國立清華大學生醫工程與環境科學學系

國立清華大學生物醫學工程研究所

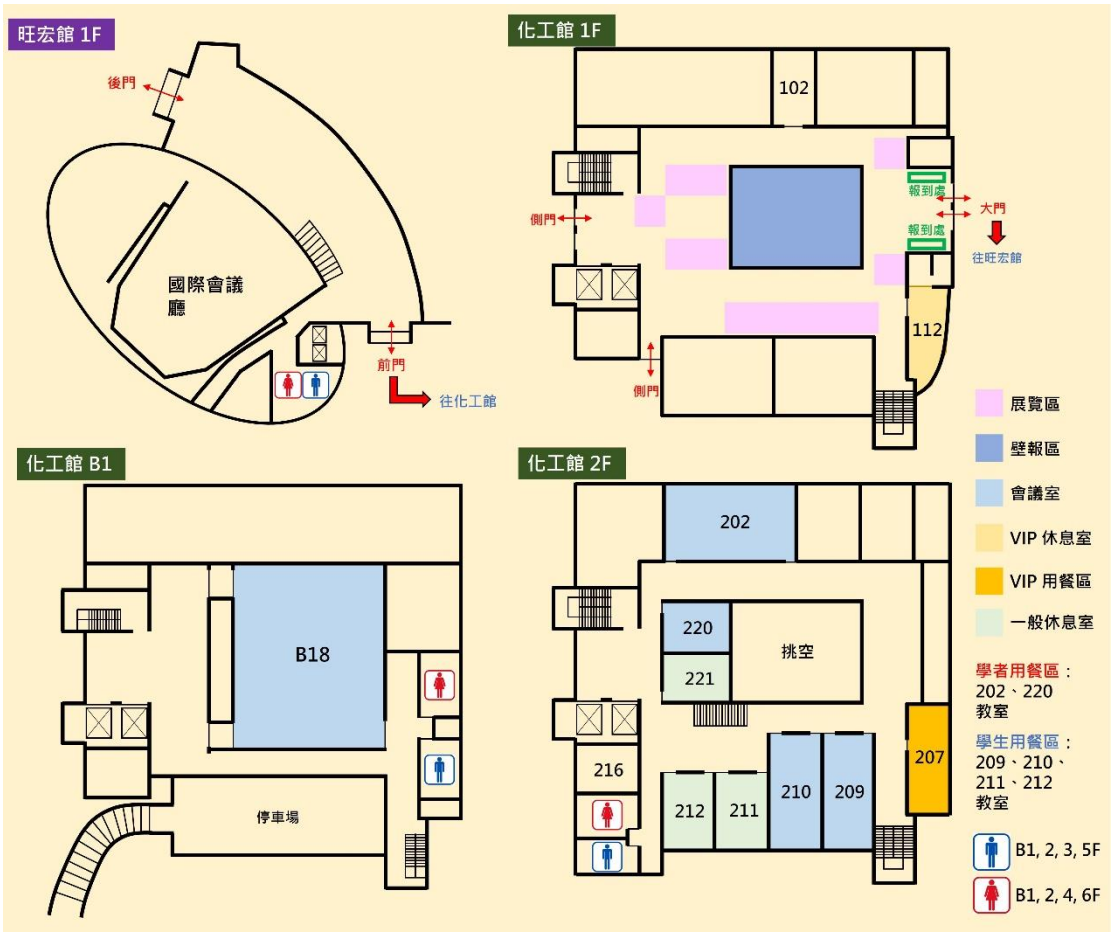
國立陽明交通大學

國立台北科技大學高值生醫材料研究與商品化中心

臺北醫學大學

臺北醫學大學生醫材料暨組織工程研究所

## 會場平面圖/與會者資訊




**報到處: 化工館 1F**

**開幕式: 旺宏館 1F 國際會議廳**

**講廳: B18、202、209、210、220**

**學生用餐區: 209(午間講座)、210(午間講座)、211、212**

**學者用餐區: 202、220**

**工作人員室: 216**

**BCRS 理監事會議: R102**

**BCRS 會員大會: B18**

**晚宴: 菜園上海餐廳(300 新竹市東區東大路一段 136 號)**

**閉幕式: B18**

**接駁車交通資訊:**

**8/15 8:10 (2 班次) 新竹高鐵站四號出口-清大化工館(報到處)**

**8/15 9:10 (2 班次) 新竹高鐵站四號出口-清大化工館(報到處)**

**8/15 18:00 清大化工館-菜園 8/15 20:40 菜園-清大-高鐵站/ 菜園-清大-和選旅**

**8/16 13:00 清大化工館-高鐵站**

## PROGRAM AT A GLANCE-DAY1(2024/8/15)

<table>
<tr><td>8:30-9:00</td><td colspan="6">Registration (CHE Building)</td></tr>
<tr><td>9:00-9:20</td><td colspan="6">Opening Ceremony (Macronix Building International Conference Hall)</td></tr>
<tr><td>9:20-10:05</td><td colspan="6">Plenary I - Kazunori Kataoka (Center Director,<br>Innovation Center of NanoMedicine, Kawasaki Institute of Industrial Promotion)<br>Moderator: Professor Hsing-Wen Sung (National Tsing Hua University)</td></tr>
<tr><td>10:05-10:25</td><td colspan="6">Coffee break</td></tr>
<tr><td>10:25-11:10</td><td colspan="6">Plenary II - Dr. Keelung Hong (Chairman of Taiwan Liposome Company)<br>Moderator: Dr. Maggie (Biomedical Technology and Device Research Lbs, Industrial Technology Research Institute)</td></tr>
<tr><td>11:10-11:55</td><td colspan="6">Plenary III -Dr. Jason Tai (Department of Industrial Technology, Ministry of Economic Affairs)<br>Moderator: Professor Yu-Chen Hu (National Tsing Hua University)</td></tr>
<tr><td>12:00-13:20</td><td colspan="6">Lunch</td></tr>
<tr><td rowspan="2">12:00-13:20</td><td colspan="2">CHE Building R102</td><td colspan="2">CHE Building R210</td><td colspan="2">CHE Building R209</td></tr>
<tr><td colspan="2">Board of Directors meeting by BCRS</td><td colspan="2">Introduction to instrument services by NHRI Institute of Biomedical Engineering & Nanomedicine</td><td colspan="2">Publishing in Wiley Journals (Dr, Xiaoyu Zhang)</td></tr>
<tr><td rowspan="2">13:20-15:20<br>(120 min)</td><td colspan="2">CHE Building B18</td><td>CHE Building R210</td><td>CHE Building R202</td><td>CHE R220</td><td>CHE R209</td></tr>
<tr><td colspan="2">IADDS I<br>Prof. Yizhou Dong<br>(Department of Immunology and Immunotherapy, Icahn School of Medicine at Mount Sinai, USA)<br>Dr. Anitha Thomas<br>(Research & Development, at Precision NanoSystems -now part of Cytiva)<br>Prof. Akitsu Hotta<br>(Department of Clinical Application, Center for iPS cell Research & Application (CiRA), Kyoto University)<br>Dr. De-Kuan Chang<br>(Senior Director, Cell Therapy, BeiGene, Taiwan)</td><td>Drug delivery system I<br>Prof. Chun-Liang Lo<br>(Department of biomedical engineering,National Yang Ming Chiao Tung University)<br>Prof. Fan-Gang Tseng<br>(Department of Engineering and System Science, National Tsing Hua University)<br>Dr. Dong-Ming Huang<br>(Institute of Biomedical Engineering and Nanomedicine, National Health Research Institutes, Taiwan)<br>Prof. Ching-Hsiang Fan<br>(Department of Biomedical Engineering, National Cheng Kung University, Tainan, Taiwan)</td><td>Industry Forum<br>Pei Kan<br>(Pharmosa Biopharm Inc.)<br>Dar-Jen Hsieh<br>(RD Center, ACRO Biomedical Co., Ltd.)<br>Cedric Wu<br>(VP of Innovation center of GenScript)<br>Heidi Wang, Ph. D<br>(OBI Pharma, Inc.)</td><td rowspan="2">Young Investigator Competition (YIC)</td><td>Student Oral Competition I (13:40-15:10)</td><td rowspan="2">Poster Competition Session I</td></tr>
<tr><td colspan="3">15:20-15:40</td><td colspan="3">Coffee break</td></tr>
</table>

| | CHE Building B18 | CHE Building R210 | CHE Building R202 | | CHE R209 | |
|---|---|---|---|---|---|---|
| **15:40-17:10 (90 min)** | **IADDS II**<br>**Prof. Yong Zhang**<br>(Department of Biomedical Engineering, City University of Hong Kong, SAR)<br>**Dr. Erick Co**<br>(FORMOSA PHARMACEUTICALS, INC., Taipei, Taiwan)<br>**Prof. Michihiro Nakamura**<br>(Department of Organ Anatomy and NANOMEDICINE, Graduate School of Medicine/Yamaguchi University, Japan) | **Biomaterials & Tissue Engineering I**<br>**Prof. Yi-Chang Chung**<br>(Research Center of Biomimetic and Medicare Technology, National University of Kaohsiung, Kaohsiung, Taiwan)<br>**Prof. Sheng-Sheng Yu**<br>(Department of Chemical Engineering, National Cheng Kung University, Tainan, Taiwan)<br>**Dr. Guo-Chung Dong**<br>(Institute of Biomedical Engineering & Nanomedicine, National Health Research Institutes) | **Precision Medicine**<br>**Han-Chung Wu**<br>(Institute of Cellular and Organismic Biology, Academia Sinica)<br>**Jin-Wu Tsai**<br>(Institute of Braiin Science, National Yang Ming Chiao Tung University)<br>**Pin-Kuang Lai**<br>(Institute of Atomic and Molecular Sciences, Academia Sinica, Taipei, 10617 Taiwan) | | **Student Oral Competition II (15:30-17:00)** | |
| **17:10-18:00** | **BCRS Annual General Meeting (CHE Building B18)** | | | | | |
| **18:30-20:30** | **Gala dinner (菜園上海餐廳)** | | | | | |

## PROGRAM AT A GLANCE-DAY2(2024/8/16)

<table>
<tr><td rowspan="2">8:45-9:45</td><td>CHE Building B18</td><td>CHE Building R210</td><td>CHE Building R202</td><td>CHE Building R220</td><td rowspan="2"></td></tr>
<tr><td>IADDS III<br>Jackie Kostovska<br>(Clinical Business development manager, VETTER PHARMA)<br>De Mei Leung<br>(Consultant)</td><td>Wearable device sensing technologies<br>Prof. Zong-Hong Lin<br>(Department of Biomedical Engineering, National Taiwan University, Taipei City, Taiwan)<br>Prof. Ho-Hsiu Chou<br>(Department of Chemical Engineering, National Tsing Hua University)<br>Dr. ShihTing Wang<br>(Adjunct Assistant Professor and incoming Assistant Professor, Department of Materials Science and Engineering, Northwestern University, IL, USA)</td><td>Biomaterials & Tissue Engineering II<br>Prof. Feng-Huei Lin<br>(Department of Biomedical Engineering,National Taiwan University)<br>Prof. Ching-Li Tseng<br>(Graduate Institute of Biomedical Materials and Tissue Engineering, Taipei Medical University)</td><td>Student Oral Competition III (8:45-10:15)</td></tr>
<tr><td rowspan="2">10:00-12:00</td><td>CHE Building B18</td><td>CHE Building R210</td><td>CHE Building R202</td><td rowspan="2"></td><td rowspan="2">Poster Competition Session II</td></tr>
<tr><td>IADDS IV<br>Prof. Kanyi Pu<br>(Nanyang Technological University, Singapore)<br>Prof. Hyuk Sang Yoo<br>(Dept of Medical Biomaterials Engineering, Kangwon National Univ. Chuncheon Campus, Republic of Korea)<br>Prof. Hyo-Kyung Han<br>(College of Pharmacy, Dongguk University, Goyang, Korea)<br>Dr. Jamie Tsung<br>(Pharmacy School, the University of Connecticut (UConn)</td><td>Immuno-therapy<br>Dr. Che-Ming Hu<br>(Institute of Biomedical Sciences, Academia Sinica, Taiwan)<br>Prof. Tzu-Wei Wang<br>(Department of Materials Science and Engineering, National Tsing Hua University, Hsinchu, Taiwan)<br>Dr. Yu-Jung Lin<br>(Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan)<br>Dr. Min-Yuan Chou<br>(Development Center for Biotechnology, Industrial Technology Research Institute)</td><td>Drug delivery system II<br>Prof. Chih-Kuang Yeh<br>(Department of Biomedical Engineering and Environmental Sciences, National Tsing Hua University)<br>Prof. Tse-Ying Liu<br>(Department of biomedical engineering,National Yang Ming Chiao Tung University)<br>Prof. Ming-Fa Hsieh<br>(Department of Biomedical Engineering, Chung Yuan Christian University)<br>Prof. Chih-Sheng Chiang<br>(Cell Therapy Center, CMUH)</td></tr>
<tr><td>12:00-12:30</td><td colspan="5">Award Ceremony</td></tr>
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## 大會議程 PROGRAM AT A GLANCE-DAY1(2024/8/15)

<table>
<tr><td>8:30-9:00</td><td colspan="6">Registration 報到、註冊(化工系館)</td></tr>
<tr><td>9:00-9:20</td><td colspan="6">Opening Ceremony 開幕 (旺宏館國際會議廳)</td></tr>
<tr><td>9:20-10:05</td><td colspan="6">Plenary I - Kazunori Kataoka (Center Director<br>Innovation Center of NanoMedicine Kawasaki Institute of Industrial Promotion)<br>Moderator: 國立清華大學化工系 宋信文 教授<br>(大合照)</td></tr>
<tr><td>10:05-10:25</td><td colspan="6">Coffee break</td></tr>
<tr><td>10:25-11:10</td><td colspan="6">Plenary II - 台灣微脂體 洪基隆 董事長<br>Moderator: 工研院生醫所 呂瑞梅 博士</td></tr>
<tr><td>11:10-11:55</td><td colspan="6">Plenary III -經濟部技術處戴建丞 博士(臺灣生物醫藥製造股份有限公司 董事)<br>Moderator: 國立清華大學化工系 胡育誠 教授</td></tr>
<tr><td>12:00-13:20</td><td colspan="6">Lunch</td></tr>
<tr><td rowspan="2">12:00-13:20</td><td>化工系館 R102 會議室</td><td colspan="2">化工系館 R210</td><td colspan="3">化工系館 R209</td></tr>
<tr><td>BCRS 學會現任-/新任理監事會議</td><td colspan="2">國家衛生研究院生醫工程與奈米醫學研究所貴重儀器服務介紹</td><td colspan="3">Publishing in Wiley Journals<br>(Dr, Xiaoyu Zhang)</td></tr>
<tr><td rowspan="2">13:20-15:20<br>(120 min)</td><td>化工系館 B18</td><td>化工系館 210</td><td>化工系館 202</td><td>化工系館 220</td><td>化工系館 209</td><td rowspan="2">Poster Competition Session I<br>1. 13:00 前貼海報<br>2. 13:30-15:00 海報評審，報告者須在現場<br>3. 16:00 移除海報</td></tr>
<tr><td>IADDS 講座 I<br>Prof. Yizhou Dong<br>(Department of Immunology and Immunotherapy, Icahn School of Medicine at Mount Sinai, USA)<br>Dr. Anitha Thomas<br>(Research & Development, at Precision NanoSystems -now part of Cytiva)<br>Prof. Akitsu Hotta<br>(Department of Clinical Application, Center for iPS cell Research & Application (CiRA), Kyoto University)<br>Dr. De-Kuan Chang<br>(Senior Director, Cell Therapy, BeiGene, Taiwan)</td><td>Drug delivery system 講座 I<br>駱俊良 教授<br>(國立陽明交通大學醫工系)<br>曾繁根 教授<br>(國立清華大學工科系)<br>黃東明 博士<br>(國家衛生研究院醫奈所)<br>范景翔 教授<br>(國立成功大學醫工系)</td><td>產學論壇<br>甘霈 總經理<br>(國邑藥品科技股分有限公司)<br>謝達仁 董事長<br>(亞果生醫股分有限公司)<br>Cedric Wu<br>(VP of Innovation center of GenScript)<br>王慧君執行長<br>(台灣浩鼎生技股份有限公司)</td><td>Young Investigator Competition (YIC)</td><td>學生口頭競賽 I(13:40-15:10)</td></tr>
<tr><td>15:20-15:40</td><td colspan="6">Coffee break</td></tr>
<tr><td rowspan="2">15:40-17:10<br>(90 min)</td><td>化工系館 B18</td><td>化工系館 210</td><td>化工系館 202</td><td></td><td>209</td><td></td></tr>
<tr><td>IADDS 講座 II<br>Prof. Yong Zhang<br>(Department of Biomedical Engineering, City University of Hong Kong, SAR)<br>Dr. Erick Co<br>(FORMOSA PHARMACEUTICALS, INC., Taipei, Taiwan)<br>Prof. Michihiro Nakamura<br>(Department of Organ Anatomy and NANOMEDICINE, Graduate School of</td><td>Biomaterials & Tissue Engineering 講座 I<br>鍾宜璋 教授<br>(國立高雄大學化材系)<br>游聲盛 教授<br>(國立成功大學化工系)<br>董國忠 博士<br>(國家衛生研究院</td><td>精準醫療講座<br>吳漢忠<br>(中研院細胞與個體生物研究所)<br>蔡金吾<br>(國立陽明交通大學腦科學研究所)<br>賴品光<br>(中研院原分所)</td><td></td><td>學生口頭競賽 II (15:30-17:00)</td><td></td></tr>
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|---|---|---|---|---|---|---|
| | Medicine/Yamaguchi University, Japan) | 醫奈所) | | | | |
| **17:10-18:00** | **BCRS 會員大會** | | | | | |
| **18:30-20:30** | **Gala dinner (菜園上海餐廳. 地址:300 新竹市東區東大路一段 136 號)** | | | | | |

## 大會議程 PROGRAM AT A GLANCE-DAY2(2024/8/16)

<table>
<tr><td></td><td>化工系館 B18</td><td>化工系館 210</td><td>化工系館 202</td><td>化工系館 220</td><td rowspan="2">Poster Competition Session II<br>1. 8:30 前貼海報<br>2. 9:45-11:15 海報評審，報告者須在現場<br>3. 11:30 移除海報</td></tr>
<tr><td>8:45-9:45</td><td>IADDS 講座 III<br>Jackie Kostovska<br>(Clinical Business development manager, VETTER PHARMA)<br>De Mei Leung<br>(Consultant)</td><td>穿戴式生醫感測技術講座<br>林宗宏 教授<br>(國立台灣大學醫工系)<br>周鶴修 教授<br>(國立清華大學化工系)<br>王詩婷 博士<br>(Adjunct Assistant Professor and incoming Assistant Professor, Department of Materials Science and Engineering, Northwestern University, IL, USA)</td><td>Biomaterials & Tissue Engineering 講座 II<br>林峯輝教授<br>(國立台灣大學醫工系)<br>曾靖媺教授<br>(台北醫學大學生醫材料暨組織工程研究所)</td><td rowspan="2">學生口頭競賽 III<br>(8:45~10:15)</td></tr>
<tr><td>9:45-10:00</td><td colspan="3">Coffee break</td></tr>
<tr><td rowspan="2">10:00-12:00</td><td>化工系館 B18</td><td>化工系館 210</td><td>化工系館 202</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>IADDS 講座 IV<br>Prof. David Tai Leong<br>(National University of Singapore (NUS)<br>Prof. Hyuk Sang Yoo<br>(Dept of Medical Biomaterials Engineering, Kangwon National Univ. Chuncheon Campus, Republic of Korea)<br>Prof. Hyo-Kyung Han<br>(College of Pharmacy, Dongguk University, Goyang, Korea)<br>Dr. Jamie Tsung<br>(Pharmacy School, the University of Connecticut (UConn)</td><td>免疫治療講座<br>胡哲銘 博士<br>(中研院生醫所)<br>王子威 教授<br>(國立清華大學材料系)<br>林鈺容 博士<br>(中研院應用科學研究中心)<br>周民元 博士<br>(工研院生醫所)</td><td>Drug delivery system 講座 II<br>葉秩光 教授<br>(國立清華大學醫環系)<br>劉澤英 教授<br>(國立陽明交通大學醫工系)<br>謝明發 教授<br>(中原大學醫工系)<br>江智聖 教授<br>(中國醫藥大學附設醫院細胞治療中心)</td></tr>
<tr><td>12:00-12:30</td><td colspan="4">Award Ceremony(閉幕與頒獎)</td></tr>
</table>

## 8/15 化工系館 B18

| | | |
|---|---|---|
| **IADDS 講座 I Moderator: Akitsu Hotta, Becky Chen** | | |
| **13:20-13:50** | Yizhou Dong | Lipid nanoparticles enabled mRNA therapeutics |
| **13:50-14:20** | Anitha Thomas | Enabling genomic medicine via unlocking the potential of lipid nanoparticles |
| **14:20-14:50** | Akitsu Hotta | How to deliver CRISPR-Cas tools into in vivo tissues? Non-viral delivery challenges |
| **14:50-15:20** | De-Kuan Chang | A new wave of allogeneic T cell therapy with affordability and the capacity to cure |
| **15:20-15:40** | Coffee break | |
| **IADDS 講座 II Moderator: Yong Zhang, Kevin Wu** | | |
| **15:40-16:10** | Yong Zhang | Engineered Materials and Devices for Phototherapy and Optogenetics |
| **16:10-16:40** | Erick Co | The discovery and development of clobetasol propionate ophthalmic suspension, 0.05% for the treatment of inflammation and pain following ocular surgery |
| **16:40-17:10** | Michihiro Nakamura | Biomedical applications of organosilica nanoparticles toward theranostics |
| **17:10-18:00** | 閉幕及頒獎/BCRS 會員大會 | |

## 8/15 化工系館 210

| | | |
|---|---|---|
| **Drug Delivery System 講座 I Moderator: 林宥欣、吳佳慶** | | |
| **13:20-13:50** | 駱俊良 | Nanoparticles for Treating Hypoxic Cancer Cells/Cancer Stem Cells |
| **13:50-14:20** | 曾繁根 | Organ-on-a-chip Models For Cancer Drug Screening And Safety Assessment In Vitro |
| **14:20-14:50** | 黃東明 | RBC-Derived Vesicles as A Systemic Delivery System of Doxorubicin for Improved and Inoperable Cancer Therapy |
| **14:50-15:20** | 范景翔 | Combing focused ultrasound and carbon dots-shelled microbubbles enhance sonodynamic therapy |
| **15:20-15:40** | Coffee break | |
| **Biomaterials &Tissue Engineering 講座 I Moderator: 姚少凌、陳美瑾** | | |
| **15:40-16:10** | 鍾宜璋 | Development of some skin-related biomaterials |
| **16:10-16:40** | 游聲盛 | Additive Manufacturing of Polymer gels for Wearable Ionotronics and Soft Robotics |
| **16:40-17:10** | 董國忠 | From bone regeneration to bone metastasis: Controllable Bone micro-environments to model the progression of metastatic cancers |
| **17:10-18:00** | 閉幕及頒獎/BCRS 會員大會 | |

## 8/15 化工系館 202

| 產學論壇 Moderator: 林美薇、王子威 | | |
|---|---|---|
| **13:20-13:50** | 甘霈 總經理 | Inhaled Liposome-Device Combination for Self-Administration at Home |
| **13:50-14:20** | 謝達仁 董事長 | $SCCO_2$-Decellularized Kidney Scaffold for *In vivo* Kidney Regeneration |
| **14:20-14:50** | Cedric Wu | Optimizing RNA Manufacturing for Rapid RNA Therapeutic |
| **14:50-15:20** | 王慧君執行長 | Challenges and Opportunities of ADC Drug Development |
| **15:20-15:40** | Coffee break | |
| **精準醫療講座 Moderator: 王麗芳、胡尚秀** | | |
| **15:40-16:10** | 吳漢忠 | Advances in the development of mRNA-based vaccines and therapeutics |
| **16:10-16:40** | 蔡金吾 | Mitigating Neuroinflammation and Cognitive Decline in Alzheimer's Disease Using a Novel CSF1R Inhibitor |
| **16:40-17:10** | 賴品光 | Untangling the Networks of Big and Small Cancer Extracellular Vesicles |
| **17:10-18:00** | BCRS 會員大會 | |

## 8/16 化工系館 B18

| | | |
|---|---|---|
| **IADDS 講座 III Moderator: 鄭平福** | | |
| **8:45-9:15** | Jackie Kostovska | Tailored manufacturing: product specific approach from clinic to market from expert CDMO's point of view |
| **9:15-9:45** | De Mei Leung | Formulation CMC development for NCE clinical studies |
| **9:45-10:00** | Coffee break | |
| **IADDS 講座 IV Moderator: David Tai Leong, Dehui Wan** | | |
| **10:00-10:30** | David Tai Leong | Biological and Engineered Nanomaterials Induction of Endothelial Leakiness and Extracellular Vesicles as Nanotherapeutics and Metallo-Chlorophyllin Nanoparticles for Public Surfaces Sterilization. |
| **10:30-11:00** | Hyuk Sang Yoo | Nano-therapeutics decorated with biologically-recognizable niches for manipulation of cell fates |
| **11:00-11:30** | Hyo-Kyung Han | Organoclay-based nanocomposites as the non-invasive delivery systems of biomacromolecules |
| **11:30-12:00** | Jamie Tsung | Life cycle management - large volume SQ combination DP |
| **12:00-12:30** | 閉幕及頒獎 | |

## 8/16 化工系館 210

| | | |
|---|---|---|
| **穿戴式生醫感測技術講座 Moderator: 黃振煌、張淑真** | | |
| **8:45-9:05** | 林宗宏 | Thermosensitive Smart Robotic Self-Powered Sensor for Material Identification |
| **9:05-9:25** | 周鶴修 | Development of Conjugated Polymer Nanoparticles with NIR-II Fluorescence and Photocatalytic Hydrogen Production for *In Situ* Hydrogen-Photothermal Therapy of Glioblastoma |
| **9:25-9:45** | 王詩婷 | Engineering Orthogonal Breath Biomarkers for Multiplexed Cancer Diagnostics |
| **9:45-10:00** | Coffee break | |
| **免疫治療講座 Moderator: 糜福龍、張建文** | | |
| **10:00-10:30** | 胡哲銘 | Enhancing adoptive therapy and antigen-specific T cell identification with cellular polymerization technology |
| **10:30-11:00** | 王子威 | Bioinspired Adhesive Nanofibrous Hydrogel Promotes Immune Infiltration through Effective Immunochemotherapy for Osteosarcoma Treatment |
| **11:00-11:30** | 林鈺容 | Mild Heat-Mimicking Immunomodulatory Micelles for Reprogramming Tumor Microenvironment |
| **11:30-12:00** | 周民元 | Development of a Dendritic Cell-based Multimeric CD40L mRNA Cancer Vaccine and Lymph Node-targeting Nanoparticles |
| **12:00-12:30** | 閉幕及頒獎 | |

## 8/16 化工系館 202

| | | |
|---|---|---|
| **Biomaterials &Tissue Engineering 講座 II Moderator:黃玲惠、李亦淇** | | |
| **8:45-9:15** | 林峯輝 | Iron-doped Calcium Sulfide Magnetic Nanoparticles as Thermoseeds for Hyperthermia |
| **9:15-9:45** | 曾靖孋 | Hyaluronic acid surface-modified nanomedicine for the treatment of retinopathy in mice with blue light-induced damage |
| **9:45-10:00** | Coffee break | |
| **Drug Delivery System 講座 II Moderator: 姚俊旭、李宇翔** | | |
| **10:00-10:30** | 葉秩光 | Functional Ultrasound Imaging-guided Acoustic Vortex Tweezers in Thrombolysis |
| **10:30-11:00** | 劉澤英 | Lanthanide-based Nanomedicines to Enhance the Efficacy of Adjuvant Radiotherapy for Treating Cancer |
| **11:00-11:30** | 謝明發 | Porcine Platelet Lysate for Cartilage Repair and Wound Healing |
| **11:30-12:00** | 江智聖 | Therapeutic fucoidan nanoparticles: from combination immunotherapy and advanced cell delivery to translational nanomedicine |
| **12:00-12:30** | 閉幕及頒獎 | |

# 大會講者-Kazunori Kataoka, Ph.D.

2024年8月15日 星期四 (9:20-10:05)

*旺宏館國際會議廳*

**Kazunori Kataoka, Ph.D.**
Center Director
Innovation Center of NanoMedicine
Kawasaki Institute of Industrial Promotion
Kawasaki, Japan
Email: k-kataoka@kawasaki-net.ne.jp/kkataoka@g.ecc.u-tokyo.ac.jp

Prof. Kazunori Kataoka is a Professor Emeritus at the University of Tokyo and the Founding Center Director of the Innovation Center of NanoMedicine (iCONM), Kawasaki Institute of Industrial Promotion. Over the past 40 years, Prof. Kataoka has made significant contributions to the fields of biomaterials, particularly in drug delivery/drug targeting, non-viral gene delivery, and nanomedicine. He has published over 600 peer-reviewed articles with over 100,000 citations (h-index of 166). He has been certified as a Highly Cited Researcher (Clarivate Analytics) for the past eight years since 2016. He also has over 600 issued patents and founded five start-ups. Awards include the Clemson Award (the Society for Biomaterials) (2004), the Founder's Award (Controlled Release Society) (2006), the NIMS Award (National Institute of Materials Science, Japan) (2009), the Humboldt Research Award (2012), the Leo Esaki Prize (2012), Gutenberg Research Award (2015), Princess Takamatsu Cancer Research Fund Prize (2017), Biomaterials Global Impact Award (2023), and Clarivate Citation Laureate in Chemistry (2023). He has been elected as a Member of the Engineering Academy of Japan (2011), an International Member of the US National Academy of Engineering (2017), and a Fellow of the US National Academy of Inventors (2017).

**Representative Publications:**

1. H. Cabral*, J. Li, K. Miyata, K. Kataoka*, "Controlling the biodistribution and clearance of nanomedicines," *Nature Rev. Bioeng*. Published online.
2. T. A. Tockary, S. Abbasi, M. Matsui- Masai, A. Hayashi, N. Yoshinaga, E. Boonstra, Z. Wang, S. Fukushima, K. Kataoka*, S. Uchida*, "Comb-structured mRNA vaccine tethered with short double-stranded RNA adjuvants maximizes cellular immunity for cancer treatment," *Proc. Natl. Acad. Sci. USA* **120**(29), e2214320120 (2023).
3. P. Chen, W. Yang, K. Nagaoka, G. L. Huang, T. Miyazaki, T. Hong, S. Li, K. Igarashi, K. Takeda, K. Kakimi*, K. Kataoka*, H. Cabral*, "An IL-12-based nanocytokine safely potentiates anticancer immunity through spatiotemporal control of inflammation to eradicate advanced cold tumors," *Adv. Sci.* **10**(10), 2205139 (2023).
4. S. Quader, K. Kataoka*, H. Cabral*, "Nanomedicine for brain cancer," *Adv. Drug Deliv. Rev.* **182**, 114115 (2022)
5. J. Li, K. Kataoka*, "Chemo-physical strategies to advance the in Vivo functionality of targeted nanomedicine: The next generation," *J. Am. Chem. Soc.* **143**(2), 538-559 (2021).
6. T. Yang, Y. Mochida, X. Liu, H. Zhou, J. Xie, Y. Anraku, H. Kinoh, H. Cabral*, K. Kataoka*, "Conjugation of glucosylated polymer chains to checkpoint blockade antibodies augments their efficacy and specificity for glioblastoma," *Nature Biomed. Eng.* **5**(11), 1274-1287 (2021).

**Polymer-based Engineered Nanosystems for Smart Therapy of Intractable Diseases**

**Kazunori Kataoka**

Innovation Center of NanoMedicine, Kawasaki Institute of Industrial Promotion, 3-25-14 Tonomachi, Kawasaki-ku, Kawasaki, Kanagawa 210-0821, Japan

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**ABSTRACT**

The development of virus-sized NanoDDS constructed based on the self-organization of precisely designed macromolecules is expected not only to facilitate the delivery of small molecule drugs but also to expand to targeting new modalities such as nucleic acid drugs and proteins, as well as to the development of contrast agents for imaging diagnostics. This presentation will focus on polymer micelle-type DDS (PM-DDS) among NanoDDS, explaining their current status and future trends. Based on the self-organization of block copolymers, PM-DDS has a particle size scale of 10-100 nm, comparable to viruses, and features a two-phase structure consisting of a core containing drugs and a shell responsible for biocompatibility. I will highlight our development of PM-DDS for delivering nucleic acid-based drugs (siRNA, ASO, mRNA, etc.), particularly those that have progressed to the clinical stage.

**References:**

1.H. Cabral, J. Li, K. Miyata, K. Kataoka, Controlling the biodistribution and clearance of nanomedicines. Nat. Rev. Bioeng. 2(3), 214-232 (2024) (DOI: 10.1038/s44222-023-00138-1).
2.S. Quader, K. Kataoka, H. Cabral, Nanomedicine for brain cancer. Adv. Drug Deliv. Rev. 182, 114115 (2022) (DOI: 10.1016/j.addr.2022.114115)
3.P. Mi, K. Miyata, K. Kataoka, H. Cabral, Clinical translation of self-assembled cancer nanomedicines. Adv. Therap.4(1), 2000159 (2021) (DOI: 10.1002/adtp.202000159)
4.J. Li, K. Kataoka, Chemo-physical strategies to advance the In Vivo functionality of targeted nanomedicine: The next generation. J. Am. Chem. Soc. 143(2), 538-559 (2021) (DOI: 10.1021/jacs.0c09029)
5.H. Cabral, H. Kinoh, K. Kataoka, Tumor-targeted nanomedicine for immunotherapy. Acc. Chem. Res. 53(12), 2765-2776 (2020) (DOI: 10.1021/acs.accounts.0c00518)
6.P. Mi, H. Cabral, K. Kataoka, Ligand-installed nanocarriers towards precision therapy. Adv. Mater. 32(13), 1902604 (2020) (DOI: 10.1002/adma.201902604)
7.S. Uchida, K. Kataoka, Design concepts of polyplex micelles for in vivo therapeutic delivery of plasmid DNA and messenger RNA. J. Biomed. Mater. Res. A 107(5), 978-990 (2019) (DOI: 10.1002/jbm.a.36614)
8.H. Cabral, K. Miyata, K. Osada, K. Kataoka, Block copolymer micelles in nanomedicine applications. Chem. Rev. 118(14), 6844-6892 (2018) (DOI: 10.1021/acs.chemrev.8b00199).

# 大會講者-Keelung Hong

2024年8月15日 星期四 (10:25-11:10)

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**EDUCATION**

**Ph.D.**, Chemistry, University of California, Berkeley, 1975
**M.S.**, Chemistry, University of Texas, El Paso, 1970
**B.S.**, Chemistry, Cheng Kung University, Taiwan, 1965

**RESEARCH EXPERIENCE**

1999-2004
Chief Scientific Officer, Hermes BioSciences Inc., S. San Francisco, California
1998-2002
Scientist, California Pacific Medical Center Research Institute, San Francisco
1998
Associate Research Biochemist, Department of Biopharmaceutical Sciences, University of California, San Francisco (UCSF)
1994-1997
Associate Research Biochemist, Department of Cellular & Molecular Pharmacology, UCSF
1991-1994
Associate Research Biochemist, Cancer Research Institute, UCSF
1979-1991
Assistant Research Biochemist, Cancer Research Institute, UCSF
1979
Research Associate, Department of Anesthesia, Stanford University School of Medicine
1977-1978
Postdoctoral Fellow, Department of Anesthesia, Stanford University School of Medicine
1976-1977
Recipient of National Institutes of Health's National Service Award, UC Berkeley
1975-1976
Sloan Postdoctoral Trainee in Neuroscience, UCSF
1970-1975
Ph.D. Research, University of California, Berkeley
1968-1970
M.S. Research, University of Texas, El Paso
1966-1968
Research Assistant, Cheng Kung University, Taiwan

**Keelung Hong,Ph.D.**

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**ABSTRACT**

A brief review of Dr. Hong's two careers: academic research and pharmaceutical developments. His graduate research was to isolate and purify membrane protein for study in defining the structure and function relationship of bio-membranes. Dr. Hong's first publication in 19721 demonstrated for the first time that bio-membrane function (visual excitation) can be reconstituted from defined membrane protein and lipid components. Through this research, he has been familiar with the chemistry of lipids, natural or synthesized; and the physical chemistry of amphiphiles especially in the aspect of self-assembled into micelles and bilayer vesicles. Taking up a totally different kind of research, Dr. Hong went to Stanford University as a post doctor in anesthesiology. At that time, anesthetics were suspected as causing health problems to those regularly exposed to them, particularly in operating rooms. Dr. Hong demonstrated that in vivo anaerobic condition highly active free radicals were produced2. The editor of Anesthesiology was so impressed with the paper reporting his results that he invited a prominent anesthesiologist to write an editorial extolling the paper. At that time, Dr. Hong learned about the methodologies of drug metabolism that he would use in later pharmacological research.

Dr. Hong's involvement in drug delivery started in 1979 after joining Liposome Research Laboratory at UCSF. LRL focused on two aspects of research, namely Ca++-dependent membrane fusion and lipid-based drug delivery. After a Ca++-dependent phospholipid-binding protein (Annexin V) was demonstrated as an important factor to lower Ca++ threshold for membrane-fusion in exocytosis3, disagreeing with the speculations on liposome-cell interaction, Dr. Hong's focus was switched to designing tools for following the pathway of cellular processing of liposomes which were the drug carrier both in vitro and in vivo4. Over one hundred articles were published in 3 decades.

In 1997-1998 Dr. Hong left academia and founded Taiwan Liposome Company in Taiwan and co-founded Hermes Biosciences, a spin-off from UCSF in California. Several lipid-based drugs have been developed, manufactured, and approved in various markets of anti-cancer, antifungal, and pain-management in osteoarthritis and post-surgery. Despite the old technology, TLC Biosciences currently is still able to maintain over 400 patents on lipid-based formulations of drug-pipeline.

References:

K. Hong and W. L. Hubbell (1972) Preparation and properties of phospholipid bilayers containing rhodopsin. Proc. Natl. Acad. Sci. 69:2617-2621.

K. Hong, J.R. Trudell, J.R. O'Neil, and E.N. Cohen (1980) Metabolism of Nitrous oxide by human and rat intestinal contents. Anesthesiology 52:16-19.

K. Hong, N. Düzgünes, and D. Papahadjopoulos (1981) Role of synexin in membrane fusion: enhancement of calcium-dependent fusion of phospholipid vesicles. J. Biol. Chem. 256:3641-3644

R.M. Straubinger, K. Hong, D.S. Friend, and D. Papahadjopoulos (1983) Endocytosis of liposomes and intracellular fate of encapsulated molecules: encounter with a low pH compartment after internalization in coated vesicles. Cell 32:1069-107

# 大會講者- Tai, ChienCheng

2024年8月15日 星期四 (11:10-11:55)

*旺宏館國際會議廳*

姓名：戴建丞
Name: Tai, ChienCheng

職稱：簡任技正
Job title: Senior Specialist

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Department of industrial technology, Ministry of Economic affairs

經歷：
經濟部智慧財產局　簡任技正
經濟部技術處　科長
經濟部技術處　技正
經濟部工業局　技正
台北市政府衛生局　股長

學歷：
台北醫學大學 細胞治療與再生醫學國際博士學位學程 博士
台北醫學大學 醫學研究所 碩士
台北醫學大學 藥學系 學士

Educational background:
Ph. D degree. International Ph.D. Program in Cell Therapy and Regenerative Medicine. Taipei Medical University.
Master degree. Graduate Institute of Medical Sciences, College of Medicine, Taipei Medical University.
Bachelor degree. School of Pharmacy. Taipei Medical University.

# Strategic Development of CDMO Industry

**Tai, ChienCheng**

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**ABSTRACT**

In the talk, we analyzed the global CDMO market, with a focus on small molecule drugs. In 2022, the biomedical CDMO market was valued at $174.3 billion USD, with drug CDMOs leading at $109.9 billion USD. The small molecule drug CDMO market was $89.7 billion USD, expected to grow at a CAGR of 6.5% from 2022 to 2026, while the large biologics CDMO market, including cell and gene therapy (CGT), was $20.3 billion USD, growing at a CAGR of 15.3%.

The rise of CDMOs is attributed to factors like European drug price adjustments and supportive US policies in the 1980s, along with outsourcing trends during financial crises in the 2000s and increasing biologics manufacturing complexity post-2010. Leading companies in 2022 include Lonza, Thermo Fisher Scientific, and WuXi, offering diverse services in small molecule drugs, biologics, and CGT.

Taiwan's small molecule drug CDMO industry focuses on overseas markets for API production, with companies like Formosa Lab and Scinopharm leading, while the domestic market is served by firms like Bora Pharmaceuticals and TTY Biopharm in niche areas. However, the industry faces challenges like insufficient government support, limited R&D resources, and weak global market connections.

To overcome these challenges, we recommended enhancing government support through loans and incentives, promoting R&D investment in advanced technologies and processes, attracting manufacturing talents, and fostering global collaborations to improve competitiveness and market reach.

# IADDS-主題演講者- David Tai Leong

2024年8月16日 星期五 (10:00-12:00)

*化工系館 B18*

**Associate Professor**
Department of Chemical and Biomolecular Engineering
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Email: cheltwd@nus.edu.sg

David earned his Bachelor of Engineering and his Ph.D. from the Department of Chemical Engineering and Department of Biological Sciences at NUS in 1998 and 2006 respectively. He received his postdoctoral training from Howard Hughes Medical Institute in University of Pennsylvania Medical School under Professor Morris Jay Birnbaum. His research focuses on biomaterials, nanobiology, and new materials development. His outstanding contributions have garnered him being recognized as a Fellow of the Royal Society of Chemistry. His significant contributions to the scientific community by serving as an associate editor in Bioactive Materials (IF 2023 18.0) and also serves on the Editorial/Advisory Boards of other prestigious journals like Nanoscale Horizons, Science and Technology of Advanced Materials and Food Quality and Safety. With a remarkable publication record, he has authored 181 scientific papers. His research has left a substantial impact, evident in over 18,800 citations and an h-index of approximately 73, as reported by Google Scholar.

Representative Publications:

1. Non-discriminating engineered masking of immuno-evasive ligands on tumor derived extracellular vesicles enhances tumor vaccination outcomes

2. Wang Q, Liang Q, Dou J, Zhou H, Zeng C, Pan H, Shen Y, Li Q, Liu Y, Leong DT*, Jiang W*, Wang Y*. Breaking through the basement membrane barrier to improve nanotherapeutic delivery to tumours. Nat Nanotechnol. 2024, 19, 95–105.

3. Peng F, Setyawati MI, Tee JK, Ding X, Wang J, Nga ME, Ho HK*, Leong DT*. Nanoparticles promote in vivo breast cancer cells intravasation and extravasation by inducing endothelial leakiness. Nat Nanotechnol. 2019, 14, 279-286.

4. Wan S, Wang K, Huang P, Guo X, Liu W, Li Y, Zhang J, Li Z, Song J, Yang W, Zhang X, Ding X*, Leong DT*, Wang L*. Mechanoelectronic stimulation of autologous extracellular vesicle biosynthesis implant for gut microbiota modulation. Nat Commun. 2024, 15, 3343.

5. Setyawati, MI*, Wang Q, Ni N, Tee JK, Ariga K, Ke PC, Ho HK, Wang Y*, Leong DT*. Engineering tumoral vascular leakiness with gold nanoparticles. Nat Commun. 2024, 14, 4269.

6. Li Y, Ni N, Lee M, Wei W, Andrikopoulos N, Kakinen A, Davis TP, Song Y, Ding F, Leong DT*, Ke PC*. Endothelial leakiness elicited by amyloid protein aggregation. Nat Commun. 2024, 15, 613.

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# Biological and Engineered Nanomaterials Induction of Endothelial Leakiness and Extracellular Vesicles as Nanotherapeutics

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ABSTRACT

Nanomedicine and Drug Delivery delivery systems are very advanced with multimodal strategies to release the valuable payload at the right location, at the right time under the right scenario. The first part of my talk will be on enhancing endothelial leakiness for increased engineered delivery of nanotherapeutics. Not much attention is paid on helping systemic introduced nanomedicine to escape from the blood network. Here, we proposed the concept of actively inducing endothelial leakiness (NanoEL) to work with the endothelia for delivery of anti-tumor nanotherapeutics [1,2]. We also uncovered that biological nanomaterials also employ a similar NanoEL concept to get over the endothelial barrier [3]. The second part of my talk is focused on extracellular vesicles (EVs). Mechanically stimulating the in situ production of EV in vivo via an implant can restore gut microbiota homeostasis [4].

References:

[1] Setyawati, MI*, Wang Q, Ni N, Tee JK, Ariga K, Ke PC, Ho HK, Wang Y*, Leong DT*. Engineering tumoral vascular leakiness with gold nanoparticles. Nat Commun. 2024, 14, 4269.
[2] Wang Q, Liang Q, Dou J, Zhou H, Zeng C, Pan H, Shen Y, Li Q, Liu Y, Leong DT*, Jiang W*, Wang Y*. Breaking through the basement membrane barrier to improve nanotherapeutic delivery to tumours. Nat Nanotechnol. 2024, 19, 95–105.
[3] Li Y, Ni N, Lee M, Wei W, Andrikopoulos N, Kakinen A, Davis TP, Song Y, Ding F, Leong DT*, Ke PC*. Endothelial leakiness elicited by amyloid protein aggregation. Nat Commun. 2024, 15, 613.
[4] Wan S, Wang K, Huang P, Guo X, Liu W, Li Y, Zhang J, Li Z, Song J, Yang W, Zhang X, Ding X*, Leong DT*, Wang L*. Mechanoelectronic stimulation of autologous extracellular vesicle biosynthesis implant for gut microbiota modulation. Nat Commun. 2024, 15, 3343.

# IADDS-主題演講者- Hyuk Sang Yoo

2024年8月16日 星期五 (10:00-12:00)

*化工系館 B18*

**Hyuk Sang Yoo, PhD**

Professor

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**Education:**

1998-Aug. 2002 Ph.D. at Department of Biological Sciences, KAIST (Advisor: Prof. **Tae Gwan Park**)

1996-1998 M.S. Department of Biological Sciences, KAIST (Advisor: Prof. Hyoung Man Kim)

1992-1996 B.S. Department of Biological Sciences, KAIST

**Academic Career:**

Sep.2003- Aug.2004 Post-doctoral research fellow at the Biomedical Research Center, KIST

(Advisor: Dr. Seo Young Jeong)

Sep.2004-Feb.2005 Post-doctoral research fellow at Department of Biomedical Engineering, Johns Hopkins University (Advisor: **Prof. Kam W. Leong**)
Sep.2010-Aug.2011 Visiting Scholar at Department of Biomedical Engineering, Northwestern University (Sponsor: **Prof. Philip Messersmith**)

**Editorial Boards**
2016- '***Biomaterials***' (ISSN: 0142-9612, **IF 15.304**): *International Editorial Board*
2019~ '***Biomaterials Research***' (ISSN: 1226-4601, **IF 15.863**): *Editorial Board*
2019~ '***Journal of Tissue Engineering***' (ISSN: 2041-7314, **IF 7.940**): *Associate Editor*
*2022~* **'*Advanced Drug Delivery Reviews*' (**ISSN: 0169-409X, **IF 17.873**): *Guest Editor for Special Issue ('monitoring of organoid organization for therapeutic application')*
2019~ **'*Pharmaceutics*' (**ISSN: 1999-4923, **IF 6.525**): *International Editorial Board*

Research Fields: Nanofibrous meshes for biomedical applications; Targeted Delivery of Anti-Cancer Agents; Tissue Engineering; Nanowires as gene carriers

**Selected Publications:**

**1.Hyuk Sang Yoo***, Taek Gyoung Kim, Tae Gwan Park, Surface-functionalized electrospun nanofibers for tissue engineering and drug delivery, **Advanced Drug Delivery Reviews** (2009) (IF 17.873)
2.Hyesung Kim, **Hyuk Sang Yoo***, MMPs-responsive release of DNA from electrospun nanofibrous matrix for local gene therapy: in vitro and in vivo evaluation, **Journal of Controlled Releas**, (2010) (IF 11.467)

## Nano-therapeutics decorated with biologically-recognizable niches for manipulation of cell fates

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Cellular receptors and recognition molecules enable cells to react to their surroundings. Consequently, numerous strategies have been implemented to alter the fates of cells by creating such identifiable niches. The spheroid formation, which is derived from human-induced pluripotent stem cells (hiPSCs), creates a three-dimensional (3D) microenvironment that promotes cell-cell interactions, modulates epigenetic regulation, and replicates early embryonic development. These properties are beneficial for biomedical applications, such as drug discovery, disease modeling, and cell replacement therapy. The pluripotency and differentiation capability of 3D hiPSC spheroids were improved by the incorporation of surface-engineered nanofibrils in this study. Cell adhesion peptides that resemble the properties of vitronectin and laminin were employed to chemically immobilize polymeric nanofibrils. The incorporation of nanofibrils into hiPSC spheroids substantially enhanced their viability and undifferentiated state. This may be attributed to the facilitated mass transport across the spheroids, which is facilitated by the loosely held structure of cells and nanofibrils. We were able to induce differentiation into the hepatic lineage by utilizing the enhanced pluripotency of hiPSC spheroids with nanofibrils. Our findings revealed a substantial increase in the expression of mature hepatocyte-specific markers in spheroids with nanofibrils when compared to those without. Consequently, the integration of surface-engineered nanofibrils with 3D hiPSC spheroids presents a prospective method for improving pluripotency and hepatic differentiation, which has the potential to have a significant impact on regenerative medicine.

**References:**

[1] Wanho Jo et al. Nanofibril guided spheroid formation for enhanced pluripotency and differentiation of human induced pluripotent stem cells. Chemical Engineering Journal 2024; 492: 151900.

# IADDS-主題演講者- Yong Zhang

2024年8月15日 星期四 (15:40-17:10)

*化工系館 B18*

**Yong Zhang**
Chair Professor & Head
Department of Biomedical Engineering
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Professor Yong Zhang is currently a Chair Professor and Head of Department of Biomedical Engineering at City University of Hong Kong. Before joining CityU, he was Provost's Chair Professor and had over 20 years of working experience in the Department of Biomedical Engineering at the National University of Singapore (NUS). Prof Zhang's research interests include functional nanomaterials and miniaturized devices for wireless phototherapy and optogenetics, upconversion nanoparticles and microfluidic devices for point-of-care diagnostics, and wearable/implantable technologies for healthcare applications. He has authored over 300 research articles in peer-reviewed journals such as Nature Medicine, Nature Biomedical Engineering and PNAS, and delivered many plenary/keynote/invited talks in international conferences. He is a highly cited researcher named by Clarivate. Prof Zhang has served in the editorial/advisory boards of journals such as Chemical Society Reviews. He has received many awards such as Humboldt Research Award and IES Prestigious Engineering Achievement Award, and has recently been awarded the prestigious Global STEM Professorship by the Hong Kong SAR. He is an elected Fellow of Singapore Academy of Engineering (FSAEng) and Royal Society of Chemistry (FRSC). He is also a founder of four startups to commercialize the technologies developed in his lab.

**Representative Publications:**

1.A Bansal, S Shikah, Y Zhang*, "Towards translational optogenetics", *Nature Biomedical Engineering* 7: 349–369, 2023.
2.ZD Lei, X Ling, QS Mei, S Fu, J Zhang, Y Zhang*, "Excitation navigating energy migration of lanthanide ions in upconversion nanoparticles", *Advanced Materials* 32(9), 1906225, 2020.
3.QS Mei, A Bansal, MKG Jayakumar, ZM Zhang, J Zhang, H Huang, DJ Yu, CJA Ramachandra, TW Soong, Y Zhang*, "Manipulating energy migration within single lanthanide activator for switchable upconversion emissions towards bidirectional photoactivation", *Nature Communications* 10, 4416, 2019.
4.Z Zhang, MKG Jayakumar, X Zheng, S Shikha, Y Zhang, A Bansal, DJJ Poon, PL Chu, ELL Yeo, MLK Chua, SK Chee, Y Zhang*, "Upconversion superballs for programmable photoactivation of therapeutics", *Nature Communications* 10, 4586, 2019.
5.A Bansal, FY Yang, T Xi, Y Zhang*, JS Ho, "In vivo wireless photonic photodynamic therapy", *PNAS* 115(7): 1469-1474, 2018.
6.K Kwek, S Ranjan, Y Zhang*, "Rotational separation of non-spherical bioparticles using I-shaped pillar arrays in a microfluidic device", *Nature Communications* 4, 1625, 2013.
7.NM Idris, J Zhang, PCL Ho, R Mahendran, Y Zhang*, "In-vivo photodynamic therapy using upconversion nanoparticles as remote controlled nano-transducers", *Nature Medicine*, 18: 1580–1585, 2012.
8.MK Gnanasammandhan, NM Idris, Y Zhang*, "Remote activation of biomolecules in deep tissues using NIR-to-UV upconversion nanotransducers", PNAS 109(22): 8483-8488, 2012.

# Engineered Materials and Devices for Phototherapy and Optogenetics

**Yong Zhang**[1*]

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**ABSTRACT**

Light has proven useful in a wide range of biomedical applications such as optogenetics and photodynamic therapy (PDT). Optogenetics use light to active light-responsive proteins that modulates a specific cell function and PDT uses light to active light-sensitive drugs that produce reactive oxygen species for cell killing. PDT has been clinically proven effective in treating early lung, bladder, head and neck cancer and is the primary treatment for skin cancer. However, their clinical applications are severely constrained by the low penetration depth of UV/visible light through thick tissue, limiting its use to target areas only a few millimeters deep. One way to improve the range is to use nanomaterials or miniaturized devices as transducers to convert deep-tissue penetrating radiations to UV/visible light suitable for activating light-sensitive proteins/drugs, extending the depth. We have demonstrated some new treatment modalities for wireless optogenetics and cancer phototherapy in deep tissues using NIR light or X-ray activatable nanomaterials, light-emitting hydrogel implants, and radiofrequence-activated micro-LEDs. Use of these technologies can be extended to other light-based applications.

**References:**

[1] Tsang CY, Zhang Y. Nanomaterials for light-mediated therapeutics in deep tissue. Chemical Society Reviews 2024;53: 5862–5903.

[2] Bansal A, Shikha S, Zhang Y. Towards Translational Optogenetics. Nature Biomedical Engineering 2023; 7: 349-369.

# IADDS-主題演講者- Hyo-Kyung Han

2024年8月16日 星期五 (10:00-12:00)

*化工系館 B18*

**Hyo-Kyung Han Professor**
College of Pharmacy
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Dr. Hyo-Kyung Han is a professor at the college of pharmacy in Dongguk University, Korea. She received BS in 1988 and MS degree in 1990 at the college of pharmacy in Seoul National University. After graduation, she joined the Korean Institute of Science and Technology (KIST) as a medicinal chemist and worked for 2 years. Then, she moved to US and received Ph.D. in 1998 at the college of pharmacy in the University of Michigan under the guidance of Prof. Gordon L. Amidon. After working as a post-doctoral research fellow in the University of Michigan, she started her career at Pfizer Inc. in 1999. She had worked as a project leader at Pfizer until 2004 and then she joined Chosun University in Korea as an assistant professor. Since 2013, she is a full professor at the college of pharmacy in Dongguk University. She extends her contribution in professional societies. She has served as an Editor-in-Chief, *Journal of Pharmaceutical Investigation* for 8 years and also participates in the editorial advisory boards of some international journals including *Drug Metabolism and Pharmacokinetics*, and *Pharmaceutics*. In 2024, Prof. Han is the president of the Korean Society of Pharmaceutical Sciences and Technology (KSPST) and also serves as the chair for Controlled Release Society (CRS) Korea Local Chapter. Prof. Han received the honorable 'Presidential Commendation' from Korean Government in 2022 for her academic contributions. Her research interest includes nanomedicines, target selective drug delivery systems, and multifunctional hybrid nano-carriers.

**Representative Publications:**

1.Bajracharya R, Baral KC, Lee SH, Song JG, Han HK. Organometallic Phyllosilicate-Gold Nanocomplex: An Effective Oral Delivery System of Methotrexate for Enhanced in vivo Efficacy Against Colorectal Cancer. Int J Nanomedicine. 18:7257-7266, 2023.

2.Lee SH, Song JG, Han HK. Site-selective oral delivery of therapeutic antibodies to the inflamed colon *via* a folic acid-grafted organic/inorganic hybrid nanocomposite system. Acta Pharm Sin B. 12(11):4249-4261, 2022.

3.Song JG, Lee SH, Han HK. Development of an M cell targeted nanocomposite system for effective oral protein delivery: preparation, in vitro and in vivo characterization. J Nanobiotechnology. 19(1):15, 2021.

4.Lee SH, Back SY, Song JG, Han HK. Enhanced oral delivery of insulin via the colon-targeted nanocomposite system of organoclay/glycol-chitosan/Eudragit®S100. J Nanobiotechnology. 18(1):104, 2020.

5.Lee SH, Song JG, Han HK. Development of pH-responsive organic-inorganic hybrid nanocomposites as an effective oral delivery system of protein drugs. J Control Release. 311-312:74-84, 2019.

## Organoclay-based nanocomposites as the non-invasive delivery systems of biomacromolecules

**Hyo-Kyung Han**

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Protein drugs cover diverse therapeutic indications and are beneficial in the treatment of many incurable diseases. Particularly, the high target selectivity of protein drugs can reduce undesirable side effects and toxicity. Since protein drugs are primarily administered via parenteral injection because of their low bioavailability, there is a high demand for noninvasive and patientfriendly delivery systems of protein drugs, particularly for long-term therapy. However, oral delivery of protein drugs is a big challenge due to many barriers including instability in the gastrointestinal tract and low membrane permeability. To overcome these issues, various formulation approaches have been explored, including organic-inorganic hybrid materials. Among them, aminoclay (3-aminopropyl functionalized magnesium phyllosilicate) is a nontoxic, silicate-based material that is positively charged in water [1]. In addition, aminoclay has a high adsorption capacity. This lecture introduces the brief overview on the application of aminoclay as a non-invasive drug delivery carrier of protein drugs. Aminoclay was synthesized via a *in situ* sol-gel method. The nanocomplex between aminoclay and protein drugs were fabricated via electrostatic interaction and then sequentially coated with specific targeting ligands and a pH-sensitive polymer. The structural and *in vitro* characteristics of the developed nanoparticles were evaluated using various analytical methods, and the *in vivo* therapeutic effects were also assessed in disease models. All nanoparticles were obtained in a narrow size distribution with a high entrapment efficiency (> 90%). Their structural and morphological characteristics were confirmed using Fourier transform-infrared spectroscopy, transmission electron microscopy, energy dispersive X-ray spectroscopy, and circular dichroism. The secondary structures of proteins were well maintained in the nanoparticles, and the drug release from nanoparticles was pH-dependent. Aminoclay-based nanocarriers exhibited reversible tight junction opening effect and enhanced cellular uptake of protein drugs. Accordingly, aminoclay-based nanocarriers significantly improved the intestinal drug absorption and *in vivo* efficacy of orally administered protein drugs. These results suggest that aminoclay-based nanocomposite systems may provide a new platform for the non-invasive delivery of therapeutic proteins.

**References:**

[1] Datta KKR, Achari A, Eswaramoorthy M. Aminoclay: a functional layered material with multifaceted applications. J Mater Chem A. 2013;1:6707–18.

# IADDS-主題演講者- Michihiro Nakamura

2024年8月15日 星期四 (15:40-17:10)

*化工系館 B18*

**Michihiro Nakamura, M.D., Ph.D Professor**
Department of Organ Anatomy and NANOMEDICINE
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Michihiro Nakamura has been a Professor and Chairman of the Department of Organ Anatomy and Nanomedicine at Yamaguchi University Graduate School of Medicine since 2016. He was awarded his M.D. degree from Tokushima University School of Medicine and obtained a medical license in 1992. He studied enzymology and protein engineering and was awarded his Ph.D. degree in 1997 from the Graduate School of Medicine at Tokushima University. After 3 years of clinical training as a clinical resident in rheumatology and hematology at Kyushu University, he joined the medicine faculty of Tokushima University as an assistant professor in 1999. From 2002 to 2004 he studied immunotoxin and molecular interaction as a visiting fellow in the Laboratory of Molecular Biology, National Cancer Institute, NIH in USA. His research interests include the creation and applications of multifunctional nanoparticles in biomedical research since 1999. He has developed a novel type of silica nanoparticles, organosilica particles made from a single organosilicate. He is finding new insights by applying novel imaging techniques using multifunctionalized organosilica particles. His current research activities include multifunctional organosilica nanoparticles that enable to create novel imaging systems and therapeutic applications toward cancer theranostics.

**Representative Publications:**

1.M. Nakamura*, C. Mochizuki, C. Kuroda, Y. Shiohama, J. Nakamura "Size Effect of Fluorescent Thiol-Organosilica Particles on Their Distribution in the Mouse Spleen," Colloids and Surfaces B: Biointerfaces, 228, 113397–113397, 2023.

2.C. Mochizuki, Y. Kayabe, J. Nakamura, M. Igase, T. Mizuno, M. Nakamura* "Surface Functionalization of Organosilica Nanoparticles with Au Nanoparticles Inhibits Cell Proliferation and Induces Cell Death in 4T1 Mouse Mammary Tumor Cells for DNA and Mitochondrial-Synergized Damage in Radiotherapy," Frontiers in Chemistry, 10, 907642–907642, 2022.

3.M. Nakamura*, K. Hayashi, J. Nakamura, C. Mochizuki, T. Murakami, H. Miki, S. Ozaki, M. Abe "Near-Infrared Fluorescent Thiol-Organosilica Nanoparticles that Are Functionalized with IR-820 and Their Applications for Long-Term Imaging of in Situ Labeled Cells and Depth-Dependent Tumor in Vivo Imaging," Chemistry of Materials, 32(17), 7201–7214, 2020.

4.M. Nakamura*, K. Hayashi, M. Nakano, T. Kanadani, K. Miyamoto, T. Kori, K. Horikawa "Identification of Polyethylene Glycol-Resistant Macrophages on Stealth Imaging in Vitro Using Fluorescent Organosilica Nanoparticles," ACS Nano, 9(2), 1058–1071, 2015.

5.M. Nakamura* "Biomedical Applications of Organosilica Nanoparticles toward Theranostics," Nanotechnology Reviews, 1(6), 469–491, 2012.

# Biomedical Applications of Organosilica Nanoparticles toward Theranostics

**Michihiro Nakamura**[1,2*]

[1] Department of Organ Anatomy & NANOMEDICINE, Yamaguchi University Graduate School of Medicine

[2] Research Institute for Cell Design Medical Science, Yamaguchi University

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Organosilica nanoparticles are novel nanomaterials and contain interior and exterior functionalities that allow facile surface and internal multifunctionalization (Figure 1). Various types of multifunctional organosilica nanoparticles were developed and applied to biomedical research [1]. Fluorescent thiol-organosilica particles were useful for various fluorescence imaging techniques, such as fluorescent cell labeling, functional single-cell imaging, and *in vivo* imaging [2–4]. Organosilica nanoparticles have numerous advantages with respect to biomedical applications and have recently been developed for cancer radio-theranostics. In addition we investigate cell-nanoparticle interaction using organosilica particles to developed advanced theranostics. Single-cell imaging and analysis of cells treated with multifunctional nanoparticles demonstrated their binding to cells, distribution and their impact on cellular function in ditail. Clarifying and controlling cell-nanoparticle interactions is extremely important, and will be useful for the development of innovative nano-theranostics.

**References:**

[1] Nakamura M. Biomedical applications of organosilica nanoparticles toward theranostics. Nanotechnology Reviews 2012;1:469–91.

[2] Nakamura M, Hayashi K, Nakano M, Kanadani T, Miyamoto K, Kori T, Horikawa K. Identification of polyethylene glycol-resistant macrophages on stealth imaging in vitro using fluorescent organosilica nanoparticles. ACS nano 2015;9:1058–71.

[3] Nakamura M, Hayashi K, Nakamura J, et al. Near-infrared fluorescent thiol-organosilica nanoparticles that are functionalized with IR-820 and their applications for long-term imaging of *in situ* labeled cells and depth-dependent tumor *in vivo* imaging. Chem Mater 2020;32:7201–14.

[4] Nakamura J, Shiohama Y, Röth D, Haruta T, Yamashita Y, et al. Size and surface properties of functionalized organosilica particles impact cell–particle interactions including mitochondrial activity. ACS Appl Mater Interfaces 2024;16:30980–96.

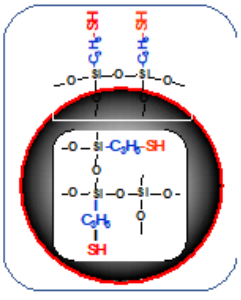

**Figure 1.** Structure of organosilica nanoparticle.

# IADDS-主題演講者- Yizhou Dong

2024年8月15日 星期四 (13:20-15:20)

*化工系館 B18*

**Yizhou Dong, Ph.D.**
Professor, Department of Immunology and Immunotherapy
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Icahn Genomics Institute
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Yizhou Dong is a Professor at the Icahn School of Medicine at Mount Sinai. He received his B.S. in pharmaceutical sciences from Peking University Health Science Center and M.S. in organic chemistry from Shanghai Institute of Organic Chemistry. In 2009, he received his Ph.D. degree in pharmaceutical sciences from the University of North Carolina at Chapel Hill (UNC-CH) under the supervision of Professor K.-H. Lee. From 2010 to 2014, he was a postdoctoral fellow in the laboratory of Professors Robert Langer and Daniel Anderson at Harvard Medical School and Massachusetts Institute of Technology. Dr. Dong joined OSU College of Pharmacy as an Assistant Professor in 2014, and was promoted to Associate Professor in 2018 before he joined his current position in 2022. His research focuses on the design and development of biotechnology platforms for the treatment of genetic disorders, infectious diseases, and cancers. Dr. Dong has authored over one hundred papers and patents. Several of his inventions have been licensed and are currently under development as drug candidates for clinical trials. He serves as a scientific advisory board member for Arbor Biotechnologies and Sirnagen Therapeutics. Dr. Dong is the recipient of multiple awards, such as Maximizing Investigators' Research Award from the National Institute of General Medical Sciences (NIGMS), Ohio State Early Career Innovator of the Year, and The American Association of Pharmaceutical Scientists (AAPS) Emerging Leader Award. Dr. Dong is an elected fellow of the American Institute for Medical and Biological Engineering (AIMBE) and also an elected fellow of the National Academy of Inventors.

**Representative Publications:**

1. Zhang, Y., Hou, X., Du, S., Xue, Y., Yan, J., Kang, D., Zhong, Y., Wang, C., Deng, B., McComb, D., Dong, Y.*, Close the cancer–immunity cycle by integrating lipid nanoparticle–mRNA formulations and dendritic cell therapy, Nature Nanotechnology, (2023).
2. Du, S., Zhang, Y., Li, W., Xue, Y., Hou, X., Yan, J., Cheng, J., Deng, B., McComb, D., Lin, J., Zeng, H., Cheng, X., Irvine, D., Weiss, R., Dong, Y.*, Cholesterol-Amino-Phosphate (CAP) Derived Lipid Nanoparticles for Delivery of Self-Amplifying RNA and Restoration of Spermatogenesis in Infertile Mice, Advanced Science, (2023).
3. Chen, S., Huang, X., Xue, Y., Benedicto, E., Shi, Y., Chen, W., Koo, S., Sigeward, D.*, Dong, Y.*, Tao, W.*, Nanotechnology-based mRNA vaccines, Nature Reviews Methods Primers, (2023).
4. Hou, X., Zaks, T.*, Langer, R.*, Dong, Y.*, Lipid nanoparticles for mRNA delivery, Nature Reviews Materials, (2021).
5. Zhang, Y., Sun, C., Wang, C., Jankovic, K., Dong, Y.*, Lipids and Lipid Derivatives for RNA Delivery, Chemical Reviews, (2021).

6. Li, Y., Su, Z., Zhao, W., Zhang, X., Momin, N., Zhang, C., Wittrup, K., Dong, Y.*, Irvine, D*., Weiss, R*., Multifunctional oncolytic nanoparticles deliver self-replicating IL-12 RNA to eliminate established tumors and prime systemic immunity, Nature Cancer, (2020).
7. Hou, X., Zhang, X., Zhao, W., Zeng, C., Deng, B., McComb, D. W., Du, S., Zhang, C., Li. W., Dong, Y.*, Vitamin lipid nanoparticles enable adoptive macrophage transfer for the treatment of multidrug-resistant bacterial sepsis, Nature Nanotechnology, (2020).

## Lipid nanoparticles enabled mRNA therapeutics

**Yizhou Dong**

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Messenger RNA (mRNA) has shown great promise for broad therapeutic applications. However, the efficient and safe delivery of mRNA remains a key challenge for the clinical use of mRNA-based therapeutics. Lipid and lipid-derived nanoparticles possess unique properties for mRNA delivery. In this talk, I will describe the development of lipid-derived nanoparticles for delivery of multiple types of mRNAs and their potential applications for treating genetic disorders, cancers and infectious diseases.

# IADDS-主題演講者- Jackie Kostovska

2024年8月16日 星期五 (8:45-9:45)

*化工系館 B18*

**Jackie Kostovska**
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**Summary of Qualifications**

•Accomplished, innovative, and determined professional with 15+ years of progressive workplace experience in business development, project management, production manufacturing, quality assurance, sales, marketing, and customer service.

•Proven track record in generating new business opportunities.

•Diverse professional background includes experience in pharmaceutical industry (sales, project management and manufacturing), real estate sales, marketing, and operations.

•Master of Business Administration (MBA) graduate (4/2014) with a concentration in General Management.

•Adept in conducting legal contracts drafting, negotiation, market, research, and client analysis.

•Pharmaceutical experience includes thirteen years of experience in bulk product manufacturing settings, aseptic fill/finish; knowledge of cGMPs and similar industry regulations.

**Professional Experience**

VETTER PHARMA — Des Plaines, IL
CLINICAL BUSINESS DEVELOPMENT MANAGER — 6/2019 – Present
Identify, qualify, and secure new business opportunities. Build business relationships with current and potential clients. Collaborate with leadership from various in-house business units to maximize product offering and to secure, retain, and grow accounts. Assess current market trends and propose new business ideas that can improve revenue margins. Present site capabilities to potential clients at client meetings, industry exhibits, trade shows, and conferences. Prepare and present proposals to clients. Negotiate legal contracts. Promote brand recognition through social media.

VETTER PHARMA — Skokie, IL
PROJECT MANAGER — 1/2015 – 6/2019
Manage early phase development projects and serve as an intermediary between internal Vetter personnel and external clients, to guide project initiatives for delivery of sterile injectable products. Serve as a liaison between internal and external customers for project activities. Coordinate and manage project teams, delegate assignments, and ensure achievement of deliverables. Support Key Account Management and Business Development Managers in project acquisitions. Determine project resources and costs. Design project processes to include: project start, project control and monitoring, project scope changes, project troubleshooting, project risk management, project conclusion and appropriate documentation.

**Education**

Keller Graduate School of Management – DeVry University, Chicago, IL
MASTER OF BUSINESS ADMINISTRATION (MBA), 4/2014

Purdue Calumet University, Hammond, IN
BACHELOR OF SCIENCE (BS), 5/2009

## Customized Drug Process Design from Clinic to Market – Perspective of a CDMO

**Jackie Kostovska, Business Development Manager**

E-mail: jackie.kostovska@vetter-pharma.com

The journey of a drug product development from preclinical stage to clinical trial and then to market is a complex, multi-phased process that involves rigorous research, testing, regulatory approval and strategic commercialization. Success in the clinical phase trials leads to compilation and submission of a New Drug Application to regulatory authorities. Following a detailed review process which includes evaluation of clinical data, manufacturing processes, and labeling, the drug may receive approval for market entry. A pivotal aspect of successful product launch and product life cycle management is selecting the right Contract Development Manufacturing Organization (CDMO). The presentation explores the key factors in designing product specific manufacturing process, key milestones in clinical drug product manufacturing, scale up and commercialization and life cycle management by an established CDMO – Vetter Pharma. It concludes that a strategic partnership with an adept CDMO, aligned with the product's requirements, can drive innovation, optimize timelines, and ultimately ensure the long-term success of pharmaceutical products.

# IADDS-主題演講者- Akitsu Hotta

2024年8月15日 星期四 (13:20-15:20)

*化工系館 B18*

**Akitsu Hotta Professor**
Place of birth: Nagoya, Japan
Favorite food: Miso-katsu (deep-fried pork cutlet served with sweet miso source [local food in Nagoya])
Interest: Playing the keyboard, Downhill skiing, Watching movies (from classic to Hollywood, but except for horror)
Special skills: DIY (including this website!)

## ■ Education and Working Experience ■

| | |
|---|---|
| March 2001 | B.Sc., Department of Engineering, Nagoya University. (Nagoya, Japan)Construction of Protein secondary structure library using C-language on UNIX system. (Go to Yamane Lab) |
| March 2006 | M.Sc. and Ph.D. (Bioengineering), Nagoya University. (Nagoya, Japan)Generation of transgenic chicken for producing pharmaceutical protein. (Go to Iijima Lab) |
| April 2006<br>~February 2010 | Postdoctoral Research Fellow<br>Developmental & Stem Cell Biology, Hospital for Sick Children. (Toronto, Canada)Development of gene therapy vectors for hemoglobinopathy and neurodevelopmental disorder Rett Syndrome, and pluripotent stem cell-specific vector for marking ES/iPS cells. (Go to James Ellis lab) |
| June 2008<br>~February 2010 | Research Fellow, Ontario Human iPS Cell Facility. (Toronto, Canada)Optimization of iPS cell induction and characterization of iPS cell lines. (Go to the Facility website) |
| October 2010<br>~March 2014 | PRESTO (Precursory Research for Embryonic Science and Technology) Researcher,<br>Japan Science and Technology Agency (JST)."Understanding Life by iPS Cell Technology" field, Phase III (Go to the JST PRESTO website) |
| March 2010<br>~October 2016 | Principal Investigator, Assistant Professor<br>Department of Reprogramming Science, Center for iPS Cell Research & Application (CiRA), Kyoto University. (Kyoto, Japan)<br>Assistant Professor<br>Yamanaka Group, Institute for Integrated Cell-Material Sciences (iCeMS), Kyoto University. (Kyoto, Japan) |
| April 2016<br>~Present | Principal Investigator<br>Hotta Project, T-CiRA Program (Go to the T-CiRA website) |
| October 2016<br>~April 2022 | Principal Investigator, Junior Associate Professor<br>Department of Life Science Frontiers, Center for iPS Cell Research & Application (CiRA), Kyoto University. (Kyoto, Japan)<br>(Moved to Department of Clinical Application, since April 2018) |
| May 2022<br>~Present | Principal Investigator, Associate Professor<br>Department of Clinical Application, Center for iPS Cell Research & Application (CiRA), Kyoto University. (Kyoto, Japan)<br>(Go to the CiRA website) |

## ■ Honor and Award ■

| | |
|---|---|
| November 2009 | Hospital for Sick Children (SickKids)<br>Exceptional Trainee Award |
| April 2016 | The Commendation for Science and Technology by the Minister of MEXT<br>The Young Scientists' Prize |
| May 2020 | Japanese Society for Regenerative Medicine Award (Basic Research) |

## How to deliver CRISPR-Cas genome editing tools into skeletal muscle for the treatment of Duchenne muscular dystrophy

**Akitsu Hotta**[1*]

[1] Center for iPS Cell Research and Application, Kyoto University
E-mail: akitsu.hotta@cira.kyoto-u.ac.jp

Duchenne muscular dystrophy (DMD) is an intractable disease that causes atrophy of skeletal muscles throughout the body due to genetic mutations. Although the development of genome editing tools such as CRISPR-Cas9 has made it possible to repair genetic mutations, safe and efficient delivery technology is essential for the application of this technology to *in vivo* gene therapy[1]. Generally, AAV vectors are used, but they have issues such as the risk of off-target mutations due to long-term expression and the inability to administer multiple doses due to immune response. Therefore, we have developed transient protein delivery technology using virus-like particles based on lentivirus and mRNA delivery technology based on lipid nanoparticles to realize genome editing activity in skeletal muscle *in vivo*. Transient delivery of CRISPR-Cas9 RNP reduces off-target mutagenesis risk, and LNP delivery allows multiple dosing. I would like to share the current status and challenges of these new transient delivery systems.

**References:**

[1] Taha EA, Lee J, Hotta A. Delivery of CRISPR-Cas tools for in vivo genome editing therapy: Trends and challenges. **J Control Release.** 2022, 342:345-361.
[2] Watanabe K, Gee P, Hotta A. Preparation of NanoMEDIC Extracellular Vesicles to Deliver CRISPR-Cas9 Ribonucleoproteins for Genomic Exon Skipping. **Methods Mol Biol.** 2023, 2587:427-453.
[3] Kenjo E, et al., and Hotta A. Low immunogenicity of LNP allows repeated administrations of CRISPR-Cas9 mRNA into skeletal muscle in mice. **Nat Commun.** 2021, 12(1):7101.
[4] Gee P, et al., and Hotta A. Extracellular nanovesicles for packaging of CRISPR-Cas9 protein and sgRNA to induce therapeutic exon skipping. **Nat Commun.** 2020, 11(1):1334.

# IADDS-主題演講者- De-Kuan Chang

2024年8月15日 星期四 (13:20-15:20)

*化工系館 B18*

**De-Kuan Chang, Ph.D.**
Senior Director, Cell Therapy, BeiGene Taiwan

Dr. De-Kuan Chang is the Senior Director at BeiGene Cell Therapy Team. He has a broad background in oncology and immunology, with specific training and expertise in antibody engineering, drug delivery system and cell and gene therapy. Dr. Chang had more than a decade experience in drug development, including preclinical and clinical studies especially in cell and gene therapy. Prior to BeiGene, he was a junior faculty at Harvard Medical School and working at different biotech companies and pharmaceuticals, like Takeda and BMS/Juno Therapeutics. At that time, he laid the groundwork for different projects by developing effective and qualified assays, investigating disease model with PK/PD relationships, generating clinical biomarker and translational strategies, and leading preclinical studies and clinical trials.

Dr. Chang involved and successfully filed many INDs for novel biologics and cell and gene therapeutics. He also published several patents in many fields, including tumor specific antigen ligands, immunomodulatory molecules, tumor-targeted antibody, cell therapy, etc.

**A new wave of allogeneic T cell therapy with affordability and the capacity to cure**

Jhang-Sian Yu[1], Chia-Hung Lin[1], Ying-Tsen Tung[1], Fang-Pei Chang[1], Edward Po-Fan Chu[1], Shiou-Ling Jian[1], Fu-Fei Hsu[1], Ming-Chin Ko[1], Yi-Han Dai[1], Chieh-Teng Cheng[1], Tzu-Chien Kuo[1], I-Ting Chen[1], Ting-Yi Wu[1], Jin-Yi Lu[1], Ke-Hsun Hsu[1], Wei-Ting Chen[1], Darien Zhing Herr Chan[1], Yi-Ting Lai[1], Shao-Ju Weng[1], Liang-Yi Chen[1], Yuan-Yu Hsia[1], Yi-Hung Ou[1], Yo-Chuen Lin[1], Shih-Wen Huang[1], Yu-Chih Peng[1], Chien-Hsi Chen[1], Chien-Yu Hsu[1], Annie Yi-Ting Lai[1], Chih-Lung Chen[1], Chun-Yu Lin[1], Lin-Yu Liao[1], Wan-Chen Tsai[1], Hsin-Hua Cho[1], Cheng-Kai Wang[1], Lee-Yieng Lim[1], Ji-Kuan Wang[1], Yao-Yu Chen[1], Chih-Kai Yin[1], Wen-Hao Wang[1], Tsung-Hao Yeh[1], Min-Ren Chiang[1], Jen-Chih Chi[1], Lien-Szu Wu[1], Ching-Ying Huang[1], De-Kuan Chang[1,*], Alex Shih-Min Huang[1,*]

[1] BeiGene (Taiwan) Limited
E-mail: de-kuan.chang@beigene.com; alex.huang@beigene.com

Human induced pluripotent stem cells (iPSCs) provide unprecedented opportunities for cell therapies against intractable diseases and injuries due to the unique feature of iPSC for routine targeted introduction of genetic modifications and expansion of the resulting differentiated cells derived from a clonal starting cell population. Human gamma delta (γδ) T cells have extraordinary properties including the capacity for tumor cell killing. Activated γδT cells are potent for killing a broad range of tumor cells and demonstrated the capacity for tumor reduction in murine xenotransplant tumor models. Translating these findings and utilizing the unique features to develop a novel iPSC-derived-γδT (iγδT) therapeutics for delivering low-cost, affordable and accessible health care options for patients is the main BeiGene's goal of cell therapy.

BeiGene's iγδT is derived from healthy donor γδT cells that are reprogrammed and genomically edited and designed to be a hypoimmune, allogeneic, and off-the-shelf γδT cell immunotherapy. To reduce host recognition and enhance persistence of the iγδT cells, the gene editing strategy includes (i) blocking host innate and adaptive immunity, (ii) enhancing cell survival via signal brakes, and (iii) preventing specific suppressor signaling to improve persistence in the tumor environment. In addition, BeiGene also developed a novel approach, signal converter, to improve cell proliferation and antitumor durable activity.

With the remarkable success of chimeric antigen receptor (CAR)-engineered T (CAR-T) cells for treating hematological malignancies, BeiGene is also exploring to incorporate gene sequences for expression of the specific CAR construct against tumor associated antigens in the iγδT platform for cancer therapy. Compared to CAR-T cells, CAR-iγδT cells could offer some significant advantages, including: (1) better safety, such as a lack or minimal cytokine release syndrome and neurotoxicity in autologous setting and graft-versus-host disease in allogenic setting, (2) multiple mechanisms for activating cytotoxic activity, and (3) high feasibility for 'off-the-shelf' manufacturing. The results of these gene-engineered CAR-iγδTs showed robust long-term durability more than 3 weeks in the tumor rechallenging study with elevated cytokine secretion. In addition, these CAR-iγδT cells can eliminate the engrafted tumor cells in vivo with persisted cellular kinetics.

BeiGene intends to use iγδT therapy for the treatment of different cancers. These engineered iγδT cells can not only evade the adaptive and innate immune system of the host while mediating enhanced cellular expansion and persistence, but also offer the opportunity to eliminate or mitigate apheresis, wait time, complexity, product variability, and failure of ex vivo engineering associated with the current approved autologous CAR T therapies.

# IADDS-主題演講者- Anitha Thomas

2024年8月15日 星期四 (13:20-15:20)

*化工系館 B18*

**Dr. Thomas**
Precision NanoSystems

Dr. Thomas is the Director of Research & Development, at Precision NanoSystems -now part of Cytiva. She has over 20 years of expertise in developing lipid nanoparticles. She completed Ph.D. in Chemistry from Indian Institute of Science. She then worked as a CIHR postdoctoral fellow with Dr. Marcel Bally at the BC Cancer Agency, Vancouver, Canada in lipid-based drug delivery systems, and then at the Centre for Drug Research & Development (CDRD - -A Drug Development Incubator focused on maturing drug development projects from POC to commercial stage; currently known as adMare BioInnovations) developing advanced drug delivery systems for the treatment of various diseases. Dr. Thomas joined Precision NanoSystems in 2013. Her expertise includes design and development of LNPs and next generation approaches for nanomedicine development towards vaccines, non-viral cell-based therapies, and genomic medicines. She holds several patents in the field of LNP-mediated nucleic acid delivery, particularly mRNA therapeutics, vaccines and cell therapy. She currently leads Delivery Platform efforts at Cytiva- an operating company working in the life sciences sector under Danaher Corporation (NYSE: DHR)

# Enabling Genomic Medicines by Unlocking the Potential of Lipid Nanoparticles

**Anitha Thomas**

Nanomedicine, Cytiva, Vancouver, Canada

E-mail: anitha.thomas@cytiva.com

Many cellular disease targets were considered undruggable till mRNA came into mainstream with the mass immunization with mRNA LNP vaccines. As the potential of mRNA and other nucleic acid-based therapeutics is being realized, it opens an untapped potential of non-viral delivery opportunities in the field of genomic medicines. Through this talk, we convey how we explored various genomic medicine applications such as cell therapy, enzyme/protein replacement and gene editing. Platform proof of concept data for various genomic medicine applications is demonstrated using proprietary ionizable lipid comprising lipid nanoparticle library. Further, we showcase how we can accelerate an end-to-end manufacturing workflow established for key genomics medicine applications towards its journey to clinic.

# IADDS-主題演講者- DeMei Leung

2024年8月16日 星期五 (8:45-9:45)

*化工系館 B18*

**DeMei Leung (趙德美), MS., RPh**
Tel #: (650) 787-8465
Email: Demeik99@gmail.com

**CAREER HIGHLIGHTS**

Over 39 years of pharmaceutical development experience. Technical lead for NCE formulation and manufacturing process development for clinical phase 1 to 3 studies and commercialization. Responsible author for preparing the CMC drug product section for global regulatory submissions, including IND, IMPD, NDA and MAA filings. Guided and managed contract manufacturers meeting cGMP requirements. Mentored junior scientists and engineers.

**PROFESSIONAL EXPERIENCE**

**Pfizer Inc. South San Francisco, California**
Acquired Global Blood Therapeutics, Oct 2022
Senior Principal Scientist (Oct 2022 – June 2023)

Accomplished knowledge and technical transfer for the assigned projects

**Global Blood Therapeutics, South San Francisco, California**
Senior Principal Scientist, Technical Operations (Oct 2020 – Oct 2022)
Principal Scientist (April 2016 – Oct 2020)

Applied scientific knowledge and technology to develop strategy for formulation and process development; scientifically assessed critical manufacturing process parameters to develop a robust manufacturing process for drug product; led manufacturing process development from clinical manufacturing, scale up, registration batches, process validation to commercialization; as a key author prepared Module 3 CMC documents; co-managed contract manufacturers with Head of Pharmaceutical Development meeting Supply Chain demand and timeline following cGMP; supervised engineer/scientist for manufacturing of CTMs and validation work

**Key Contributions**

Held the patent of voxelotor tablet formulation
•Accomplished Oxbryta® regulatory approvals in the US and rest of world (ROW)
•Supported continued process verification (CPV) and annual report for Oxbryta®

**Onyx Pharmaceutical Inc. South San Francisco, California**
**(Acquired by Amgen, Inc in 2013)**
Associate Director, Pharmaceutical Sciences, & Technical Services (2012 – Dec 2015)
Senior Scientist, Pharmaceutical Sciences (2010 – 2012)

**EDUCATION**

M.S. in Pharmaceutics, University of Nebraska, Omaha, Nebraska
B.S. in Pharmacy, Taipei University (formerly Taipei Medical College), Taipei, Taiwan

**Formulation CMC Development for NCE Clinical Studies**

**DeMei Kate Leung, MS, RPh**

Pharmaceutical Development Consultant
E-mail: demeik99@gmail.com

The journey of formulation development for a new chemical entity (NCE) begins at the preclinical stage and continues through post-commercialization. This presentation focuses on formulation development during clinical phases 1 to 3. The Target Product Profile (TPP) and scientific knowledge of the NCE provide the foundation for formulation development. A robust formulation is developed during the clinical development stage, incorporating the principles of Chemistry, Manufacturing, and Controls (CMC). FDA Guidances outline phase-appropriate CMC activities and requirements for Investigational New Drug Applications (INDs). In this presentation, the Case 1 study demonstrates that formulation changes or modifications for an oral solid dosage form were guided and justified by CMC requirements. The Case 2 study shows that a longer development time was necessary for an injectable solution due to the lack of a TPP. To minimize the risk of later-stage failure and reduce development time, it is essential to consider and establish CMC during formulation development.

References:
[1] Guidance for Industry and Review Staff, Target Production Profile - A Strategic Development Process Tool, Draft Guidance, Food and Drug Administration, Center for Drug Evaluation and Research (CDER), March 2007, Procedural.
[2] Guidance for Industry: Content and Format of Investigational New Drug Applications (INDs) for Phase 1 Studies of Drugs, Including Well-Characterized, Therapeutic, Biotechnology-derived Products, Food and Drug Administration, Center for Drug Evaluation and Research (CDER), Center for Biologics Evaluation and Research (CBER), November 1995.
[3] Guidance for Industry: INDs for Phase 2 and Phase 3 Studies, Chemistry, Manufacturing, and Controls Information, Food and Drug Administration, Center for Drug Evaluation and Research (CDER), May 2003, CMC.

# IADDS-主題演講者- ERICK W. CO

2024年8月15日 星期四 (15:40-17:10)

*化工系館 B18*

**ERICK W. CO, PH.D.**
PRESIDENT & CHIEF EXECUTIVE OFFICER
Curriculum Vitae
erickwco@gmail.com
WeChat, LINE, Skype: erickwco
https://tw.linkedin.com/in/erickwco Mobile,
WhatsApp: +886 976 266 515

**SUMMARY OF QUALIFICATIONS**

➢ Collaborative Orientation – Cross-functional and cross-cultural (Asia: Japan, China, Taiwan; Europe; United States) experience in global project teams. Persuasive and respected leader of interdisciplinary project teams of up to 20 scientists, strategic alliances with corporate and academic research partners, and contract manufacturing organizations (CMOs).
➢ Results-Oriented Leader – Directed or co-directed more than 12 major drug discovery projects,
including a US FDA-approved treatment (APP13007, clobetasol propionate ophthalmic suspension,
0.05%) for post-operative inflammation and pain following ocular surgery. Led a multidisciplinary project team to discover a small-molecule drug development candidate within 8 months, resulting
in receipt of Takeda's Structure-Based Drug Design Award.
➢ Patented Inventor –Over 24 years' drug discovery experience leading to the invention of 7 preclinical and clinical drug candidates. Named contributor to 13 pharmaceutical patents and 5 peer-reviewed scientific journal publications and book chapters.

➢ Scientific Credentials – Ph.D. in Synthetic Organic Chemistry with expertise utilizing structure-based drug design as applied to cell homeostasis, oncology, and cardiovascular targets.

**AREAS OF EXPERTISE**

- Alliance & Portfolio Management  Fundraising and Licensing Negotiations
- Corporate and R&D management  Due diligence (licensor and licensee)
- Clinical and Regulatory Development  Workforce Retention and Reduction
- HtL, Lead-op, preclinical small molecule development, including structure-based design

**INDUSTRY EXPERIENCE**

FORMOSA PHARMACEUTICALS, INC., Taipei, Taiwan 2017 – present
Formosa Pharmaceuticals (TWO.6838) is a clinical-stage biotech with primary focus in ophthalmology and oncology. Lead program, APP13007, was recently approved by the US FDA for post-operative inflammation and pain following ocular surgery. APP13007 is derived through a proprietary and patented formulation technology (APNTTM), which improves dissolution and bioavailability via the primary principle of particle size reduction with high stability and homogeneity, and lower contamination. www.formosapharma.com.

President & Chief Executive Officer 2023 – present
Key player in the due diligence and eventual licensing of APP13007 for the United States (Eyenovia, Inc., Aug 2023) and Brazil (Laboratorio Cristaliá, Jan 2024). With AimMax Therapeutics, obtained approval of APP13007 in the United States. Recruited and expanded Formosa Pharma team to enable in-house capabilities for regulatory, CMC production, and supply chain management.
Chief Executive Officer 2019 – 2023
Chief Scientific Officer 2017 – 2019

# IADDS-主題演講者- Jamie Tsung

2024年8月16日 星期五 (10:00-12:00)

*化工系館 B18*

**Jamie Tsung, Ph.D**.
Professor in Practice, Pharmacy School, the University of Connecticut (UConn)
E-mail: Jamie.tsung@uconn.edu

Dr. Jamie Tsung is a professor in practice at the University of Connecticut (UConn), USA. She received her Ph.D. in pharmaceutical sciences from UConn and master's degree in management from Harvard University. She has 20+ years of pharmaceutical industry experience at various pharmas, including Alnylam, Momenta, Shire, Baxter, and UCB. Her biopharmaceutical experience spans preclinical to marketed products and involved in 100+ NDA, IND and CTA for small molecules, complex biologics, and therapeutic nucleic acid. Her unique CMC experience integrating formulation, characterization, processing technology, manufacturing, management of CDMOs, regulatory, and quality control provides a valuable perspective and creative approach to product development.

**EMPLOYMENT**

Alnylam Pharmaceuticals, Cambridge, MA
Head of Drug Product Formulation
Director, CMC Development

Momenta Pharmaceuticals, Cambridge, MA
Principal Scientist, Drug Product Development & Manufacturing

Shire HGT, Cambridge, MA
Group Leader, Combination Drug Product and Device Department

**PUBLICATIONS (Selected)**

J Tsung et al. Methods and compositions for CNS delivery of Heparan N-Sulfatase. US Patent: 9320711. 2016.

M. Tsung, et al. Methods of processing microparticles. European Patent: EP2334396B1. 2016

J Tsung and D. Burgess. Biodegradable polymer in drug delivery system. In "The Fundamentals of Drug Delivery". M. Rathbone, R. Siegel, and J. Shipmann. CRS Press, Springer. (2012).

M. Tsung, D. Easson JR, E. Mehr, A. Bourhis. Methods of processing microparticles and compositions produced thereby. Baxter International 2010, US 20100047292

## Practical Drug Product Considerations for Wearable Injector

**Jamie Tsung**

*University of Connectivut*

E-mail: jamie.tsung@uconn.edu

Wearable injectors are emerging as a solution to the challenges posed by the large volume of subcutaneous injections required for chronic diseases. This presentation provides insights into the advantages of wearable injectors, market trends favoring injectable drug delivery systems, and the benefits of adopting wearable injector technology. Additionally, it highlights the rationale behind transitioning to wearable injectors, showcases existing market products, discusses optimal timing for the switch, provides examples of wearable injectors, and outlines the related Chemistry, Manufacturing, and Controls (CMC) activities.

# 精準醫療講座-主題演講者-吳漢忠

2024年8月15日 星期四 (15:40-17:10)

*化工系館 202*

**Han-Chung Wu, Director**

Distinguished Research Fellow in Institute of Cellular and Organismic Biology
Director in National Biotechnology Research Park/Biomedical Translation Research Center, BioTReC, Academia Sinica.

**Academic Qualifications**

•Ph.D. Institute of Pathology, College of Medicine, National Taiwan University (1990/09-1993/12)

**Current Position & Employment History**

•Distinguished Research Fellow 09/2020-Present
- Institute of Cellular and Organismic Biology, Academia Sinica
•Director 09/2019-Present
-National Biotechnology Research Park/Biomedical Translation Research Center, Academia Sinica
•Director 2016/10-2018/12
- Department of Intellectual Property and Technology Transfer, Academia Sinica

**Scientific Awards**

•Ming-Ning Wang Award for Outstanding Contribution of Academic Research Achievements 2021
•Award for Excellent Contributions in Technology Transfer, MOST, Taiwan 2019, 2021
•National Academy of Inventors (NAI) Fellow, USA 2020
•The Executive Yuan Award for Outstanding Science and Technology Contribution 2018
•Outstanding Research Award, Ministry of Science and Technology 2011-2014, 2015-2018
•Ho Jen-Dui Distinguished Honor Award 2015

**Biography Brief**

Dr. Han-Chung Wu is currently a Distinguished Research Fellow of the Institute of Cellular and Organismic Biology, and the Director of Biomedical Translation Research Center (BioTReC), Academia Sinica, Taiwan. He is also a Professor at the College of Medicine of the National Taiwan University. His research primarily focuses on two fields, cancer research and infectious diseases, and includes components of both basic research and applied science. As of today, Dr. Wu has published over 138 original articles in world-renowned journals, and 145 Patents (including 99 granted patents and 46 filed patents; 51 Patent families). He has successfully licensed out 24 technologies from 24 patent families to biotech companies. Eight of the licensed technologies serve as the basis for products that are currently in clinical trials or already on the market. Eight of the licensed technologies are currently in preclinical studies for the development of therapeutics. Dr. Wu was elected as a Fellow of the National Academy of Inventors (NAI) of the United States in 2020. This is among the highest achievable honors for an academic inventor.

**Selected Publications**

1.Lin, C. Y., Wang, Y. L., Chi, Y. H., Chan, L. Y., Ho, C. T., Chen, G. W., Hsu, H. C., Hwang, D. W., **Wu, H. C.*** and Hung, S. C.* Collagen-binding peptides for the enhanced imaging, lubrication and regeneration of osteoarthritic articular cartilage. ***Nature Biomedical Engineering. 2022.*** 6, 1105-1117. (SCI, IF: **28.1**, Engineering, Biomedical, 1/96)

2.Li, H. J., Ke, F. Y., Lin, C.C., Lu, M. Y., Kuo, Y. H., Wang, Y. P., Lin, S. C., Chang, Y. H., Chen, H. Y., Yang, P. C. and **Wu, H. C.*** ENO1 promotes lung cancer metastasis via HGFR and WNT signaling-driven epithelial-mesenchymal transition. ***Cancer Research. 2021***. 81, 4094-4109. (SCI, IF: **11.2**, Oncology, 26/241)

3.Chen, H. N., Liang, K. H., Lai, J. K., Lan, C. H., Liao, M. Y. Hung, S. H., Chuang, Y. T. and **Wu, H. C.*** EpCAM signaling promotes tumor progression and protein stability of PD-L1 through EGFR pathway. ***Cancer Research. 2020***. 80, 5035-5050. (SCI, IF: **11.2**, Oncology, 26/241)

**Advances in the development of mRNA-based vaccines and therapeutics**

**Han-Chung Wu (吳漢忠)[1,2*]**

[1] Institute of Cellular and Organismic Biology, Academia Sinica (中央研究院細胞與個體生物學研究所)
[2]Biomedical Translation Research Center (BioTReC), Academia Sinica (中央研究院國家生技研究園區生醫轉譯研究中心)

E-mail: hcw0928@gate.sinica.edu.tw

mRNA-based drugs have tremendous potential as clinical treatments; however, a major challenge in realizing the promise of this drug class will be to develop methods for safely delivering the bioactive agents with high efficiency and without activating the immune system. Lipid nanoparticles have been utilized to improve delivery and protect the modified mRNA cargo from extracellular degradation. This advance was a major milestone in the development of mRNA vaccines and dispelled skepticism about the potential of this technology to yield clinically approved medicines. In this presentation, I will explore the potential applications of mRNA-based vaccines and therapeutics, and the design of novel ionizable cationic lipids. Additionally, I will discuss the development of safe and effective mRNA vaccines for dengue. Finally, I will address strategies for targeted delivery of mRNA LNPs to immune cells, tumors, and specific organs.

**References:**

[1] Lin, C. Y., Wang, Y. L., Chi, Y. H., Chan, L. Y., Ho, C. T., Chen, G. W., Hsu, H. C., Hwang, D. W., Wu, H. C.* and Hung, S. C.* Collagen-binding peptides for the enhanced imaging, lubrication and regeneration of osteoarthritic articular cartilage. Nature Biomedical Engineering. 2022. 6, 1105-1117.
[2] Li, H. J., Ke, F. Y., Lin, C.C., Lu, M. Y., Kuo, Y. H., Wang, Y. P., Lin, S. C., Chang, Y. H., Chen, H. Y., Yang, P. C. and Wu, H. C.* ENO1 promotes lung cancer metastasis via HGFR and WNT signaling-driven epithelial-mesenchymal transition. Cancer Research. 2021. 81, 4094-4109.
[3] Chen, H. N., Liang, K. H., Lai, J. K., Lan, C. H., Liao, M. Y. Hung, S. H., Chuang, Y. T. and Wu, H. C.* EpCAM signaling promotes tumor progression and protein stability of PD-L1 through EGFR pathway. Cancer Research. 2020. 80, 5035-5050.

# Drug delivery system 講座-主題演講者
# -駱俊良

2024年8月165日 星期四 (13:20-15:20)

*化工系館 210*

**Chun-Liang Lo, Professor**

**Current Position**

Professor. Department of Biomedical Engineering, National Yang Ming Chiao Tung University, Taiwan

**Academic Qualifications**

•Ph. D. in Department of Chemical Engineering, National Tsing Hua University, Taiwan (2005)
•M.S. in Department of Chemical Engineering, National Chung Hsing University, Taiwan (2000)
•B.S. in Department of Chemical Engineering, National Chung Hsing University, Taiwan (1998)

**Current Position & Employment History**

•Professor 02/2019 – Present
- Department of Biomedical Engineering, National Yang Ming Chiao Tung University, Taiwan
Associate Professor/ Assistant Professor 08/2009 – 01/2019
- Department of Biomedical Engineering, National Yang Ming University, Taiwan
Foreign Researcher 08/2008 – 07/2009
- Center for Disease Biology and Integrative Medicine, Graduate School of Medicine, The University of Tokyo, Japan

**Scientific Awards**

•Research Scholar Award, Professor Chau-Jen Lee Biomedical Engineering Development Foundation 2022
•National Innovation Award, Research Center for Biotechnology and Medicine Policy 2021
•2nd 505(b)(2)-[Drug Repurposing-New Formulation]-Innovation Award, Xin Chen Medical Foundation 2017
•Ta-You Wu Memorial Award, NSTC 2016
•Project for Excellent Junior Research Investigators, NSTC 2016

**Biography Brief**

Prof. Lo is a Full Professor in the Department of Biomedical Engineering at National Yang Ming Chiao Tung University. He specializes in biomaterials, nanotechnology, and drug delivery. His current research interests include investigating the interplay between cancer cells and other cells, devising targeted therapy approaches for cancer cells/cancer stem cells, and exploring novel combinatorial treatment strategies for cancer chemotherapy/immunotherapy/radiation therapy.

**Selected Publications**

1.L.Y. Yu, P.W. Shueng, H.C. Chiu, Y.W. Yen, T.Y. Kuo, C.R. Li, M.W. Liu, C.H. Ho, T.H. Ho, B.W. Wang, C.E. Li, M.H. Chen, Y.A. Shen*, C.L. Lo*. Glucose transporter 1-mediated transcytosis of glucosamine-labeled liposomal ceramide targets hypoxia niches and cancer stem cells to enhance therapeutic efficacy. *ACS Nano* **2023**, *17*, 13158-13175.
2.Y.H. Wen, P.I Hsieh, H.C.Chiu, C.W.Chiang, C.L. Lo*, Y.T. Chiang*. Precise delivery of doxorubicin and imiquimod through pH-responsive tumor microenvironment-active targeting micelles for chemo- and immunotherapy. *Mater. Today Bio* **2022**, *17*, 100482
3.P.W. Shueng, L.Y. Yu, H.C. Chiu, H.C. Chang, Y.L. Chiu, T.Y. Kuo, Y.W. Yen, C.L. Lo*. Early phago-/endosomal escape of platinum drugs via ROS-responsive micelles for dual cancer chemo/immunotherapy. *Biomaterials* **2021**, *276*, 121012.

## Nanoparticles for Treating Hypoxic Cancer Cells/Cancer Stem Cells

**Yu LY (余律誼)[1], Shen YA (沈耀安)[2*], Lo CL (駱俊良)[1*]**

[1] Department of Biomedical Engineering, National Yang Ming Chiao Tung University (陽明交通大學生物醫學工程學系)
[2] Department of Pathology, Taipei Medical University (台北醫學大學病理學科)
E-mail: cllo@nycu.edu.tw

Nanoparticles is increasingly being explored for treating hypoxic cancer cells and CSCs. One approach is to design nanoparticles that can release drugs in response to specific environments. For example, nanoparticles with thioether groups are sensitive to metastatic CSCs, while disulfide bond-containing nanoparticles are sensitive to tumor-initiating CSCs. Another approach is to use nanoparticles for targeting CSCs. Reognizing CD44 can promote the internalization of nanoparticles by CSCs [2]. However, bottlenecks such as high tumor interstitial fluid pressure and lack of vessel density limit the nanoparticle accumulation in tumor hypoxic niches. Therefore, we prepared glucosamine-labeled liposomal ceramide that can be transported from one cancer cell to another via glucose transporter 1-mediated transcytosis and then accumulated in the hypoxic niches [3]. When glucosamine-labeled liposomal ceramide is taken up by hypoxic cancer cells and CSCs, the payload, ceramide, can block hypoxia-inducible factor-1 alpha-mediated gene transcription, leading to the impediment of the self-renewal capacity and pluripotency of hypoxic cancer cells and CSCs. When glucosamine-labeled liposomal ceramide was combined with paclitaxel and carboplatin, tumor clearance was found in three-fourths of the mice. Overall, well-designed nanoparticles can effectively target and kill cancer cells and CSCs in the hypoxic niches of tumors, offering the potential to increase patient survival rates.

**References:**

[1] Yu LY, Shen YA, Chen MH, Wen YH, Hsieh PI, Lo CL. The feasibility of ROS- and GSH-responsive micelles for treating tumor-initiating and metastatic cancer stem cells. J Mater Chem. B, 2019;7: 3109–3118.
[2] Debele TA, Yu LY, Yang CS, Shen YA, Lo CL. pH- and GSH-sensitive hyaluronic acid-MP conjugate micelles for intracellular delivery of doxorubicin to colon cancer cells and cancer stem cells. Biomacromolecules, 2018;19: 3725–3737.
[3] Yu LY, Shueng PW, Chiu HC, Yen YW, Kuo TY, Li CR, Liu MW, Ho CH, Ho TH, Wang BW, Li CE, Chen MH, Shen YA, Lo CL. Glucose transporter 1-mediated transcytosis of glucosamine-labeled liposomal ceramide targets hypoxia

# Drug delivery system 講座-主題演講者 -葉秩光

2024年8月16日 星期五 (10:00-12:00)

*化工系館 202*

**Chih-Kuang Yeh, Professor**

**Current Position**

Distinguished Professor.
Department of Biomedical Engineering and Environmental Sciences, National Tsing Hua University, Taiwan

**Academic Qualifications**

•**Doctor of Philosophy, Electrical Engineering,** National Taiwan University, Taipei, Taiwan, January 2004.

**Current Position & Employment History**

•**Chair**, Department of Biomedical Engineering and Environmental Sciences, National Tsing Hua University, Hsinchu, Taiwan. (02/2020-01/2023)
•**Professor**, Department of Biomedical Engineering and Environmental Sciences, National Tsing Hua University, Hsinchu, Taiwan. (08/2012-present)

**Scientific Awards**

•**Outstanding Research Award**, National Science and Technology Council (NSTC), Taiwan, 2024.
•**The 58th Sun Yat Sen Academic Award**, Sun Yat Sen Academic and Cultural Foundation, 2023.
•**The 30th TECO Award**, TECO Technology Foundation, 2023.
•**The 19th Tien Te Lee Biomedical Award**, Tien Te Lee Biomedical Foundation, 2023.
•**IAMBE Fellow,** International Academy of Medical and Biological Engineering, 2023.

**Biography Brief**

Prof. Yeh's primary research field is ultrasound technology in biomedical applications. He has received numerous awards, including the Wu Dayou Memorial Award from the National Science and Technology Council of Taiwan (NTSC), the Outstanding Research Award by NTSC, and the Future Science and Technology Award twice by NTSC. He currently holds the position of distinguished professor at NTHU and is a fellow of International Academy of Medical and Biological Engineering (IFMBE fellow) and a senior member of the IEEE Society as well as an editor for three SCI journals. Professor Yeh has published over 160 papers and has presented over 200 proceedings abstracts/papers at seminars and conferences. Professor Yeh has extensive experience in implementing industry-university cooperation and has obtained 19 patents. He has also started two companies that specialize in ultrasound contrast agents (Trust Bio-sonics, 2013) and catheter-based ultrasound (SoundJet Medical, 2022). In terms of social services, while serving as the convener of the biomedical engineering division at NTSC of Taiwan, he promoted the development of innovative medical devices and made contributions to bilateral international research collaboration and academic conference exchanges.

**Selected Publications**

1.C. H. Fan, H. C. Tsai, Y. S. Tsai, H. C. Wang, Y. C. Lin, P. H. Chiang, N. Wu, M. H. Chou, Y. J. Ho, Z. H. Lin, **C. K. Yeh***, "Selective Activation of Cells by Piezoelectric Molybdenum Disulfide Nanosheets with Focused Ultrasound," ***ACS Nano***, 17(10), 9140-9154, 2023. (IF=**17.1**, Materials science, multidisciplinary, 20/344)
2.W. C. Lo, C. H. Fan, Y. J. Ho, C. W. Lin, **C. K. Yeh***, "Tornado-Inspired Acoustic Vortex Tweezer for Trapping and Manipulating Microbubbles," ***Proceedings of the National Academy of Sciences of the United States of America***, 118(4), 11794-11819, 2021. (Selected as feature article "In This Issue") (IF=**11.1**, Multidisciplinary sciences, 8/73)
C. H. Fan, K. C. Wei, N. H. Chiu, E. C. Liao, H. C. Wang, R. Y. Wu, Y. J. Ho, H. L. Chan, T. S. A. Wang, Y. Z. Huang, T. H. Hsieh, C. H. Lin, Y. C. Lin*, **C. K. Yeh***, "Sonogenetic-based Neuromodulation for the Amelioration of Parkinson's Disease," ***Nano Letters***, 21(14), 5967-5976, 2021.

## Functional Ultrasound Imaging-guided Acoustic Vortex Tweezers in Thrombolysis

**Chih-Kuang Yeh (葉秩光)**

Department of Biomedical Engineering and Environmental Sciences, National Tsing Hua University
(清華大學 生醫工程與環境科學系)
E-mail: ckyeh@mx.nthu.edu.tw

The aim of this study is to develop a functional sonography guided acoustic vortex tweezer (AVT) system to increase the local concentration of thrombolytic drugs for theranostic thrombolysis. The AVT can concentrate thrombolytic agents (tPA)-loaded microbubbles (tPA-MBs) within thrombosed vessels. In the meantime, the concentration and location of tPA-MBs were monitored by plan wave ultrafast sonography imaging. Subsequently, these tPA-MBs can be triggered to release tPA drugs and to generate microstreaming at thrombosis area by low frequency ultrasound, improving the efficiency of thrombolysis. Since the AVT and tPA-MBs generate shear waves in the thrombus during treatment, these shear waves can be used to generate elastic images of the thrombus for estimating the distribution of softness and hardness, thereby achieving real-time therapeutic purpose. These experiments were conducted by an *in vitro* thrombolysis model with flow condition. The *in vivo* thrombolysis effect and safety issues were also assessed by histologic examinations and behavior tests on mice and rat animal models.

# Biomaterials & Tissue Engineering 講座-
# 主題演講者-鍾宜璋

2024年8月15日 星期四 (15:40-17:10)

*化工系館 210*

**Yi-Chang Chung, Professor**

**Current Position**

Distinguished Professor. Department of Chemical and Materials Engineering, National University of Kaohsiung, Taiwan

**Academic Qualifications**

•Ph. D. in Department of Chemical Engineering, National Cheng-Kung University, Taiwan (09/1992 – 07/1996)
•B.S. in Department of Chemical Engineering, National Cheng-Kung University, Taiwan (09/1987 – 06/1991)

**Current Position & Employment History**

•Professor/ Associate Professor/ Assistant Professor, Department of Chemical and Materials Engineering, National University of Kaohsiung, Taiwan (08/2003-)
•Assistant Professor, Department of Chemical Engineering, I-Shou University, Taiwan (08/1999 – 07/2003)
•Postdoctoral Research Fellow, Department of Chemical Engineering, National Cheng-Kung University, Taiwan (08/1996 – 07/1997)

**Scientific Awards**

•MOST Special Outstanding Talent Award (National University of Kaohsiung) 2011-2023
•Distinguished Professor Award 2023
•Outstanding Industry-university Cooperative Research Award 2017, 2020, 2023

**Biography Brief**

Prof. Chung is hosting the NanoBiomaterials lab to conduct some research on biomedical nanoparticles, nano/micropatterning techniques, biomimetic surface treatment, biocompatible coatings, optical biosensors, and so forth. He is also focusing on cooperation with industries for their R&D affairs and push more than 70 technology transfer cases and cooperative projects. He has been rewarded by the "MOST Special Outstanding Talent Award" from the Minister of Science and Technology of Taiwan since 2011 to now, and obtained the 2013 "Outstanding Faculty Teaching Award" of NUK. Recently, he has been leading a team to perform biomimetic strategy for industrial, biomedical, and commodity uses, and created the Research Center of Biomimetics and Medicare Technology. He and his coworkers won the Gold medals of 2014 International Kaohsiung Invention Exhibition, and 2015 Taipei International Invention and Trade Show. They also won the Outstanding entrepreneurship award in the 2014 Entrepreneurship contest of Ministry of Science and Technology of Taiwan, and 2015 TechConnect Innovation Awardee at TechConnect National Innovation Summit, Washington, D.C.. also consecutively rewarded by the "Outstanding Industry-university Cooperative Research Award" (2017, 2020, 2023). The "Biomimetic dry adhesives" design was awarded in the "Future Tech Award 2019", and further design of "Smart adhesives with rapid response and controllable adhesion" was awarded in the "Future Tech award 2022".

**Selected Publications**

1.Tzu-Yu Kuo, Yi-Chang Chung* (2021) "Surface-initiated polymerization of mussel-inspired dopamine for hydrophilic coatings", Materials Advances, 2, 5686-5690.
2.Fan-Yi Li, Yi-Chang Chung* (2022) "Fabrication of "electroactive cells" using bio-inspired polydopamine-derived carbon nanoparticles for manipulation of cells with electrical stimulation", Frontiers in Bioengineering and Biotechnology, 10:949308. doi: 10.3389/fbioe.2022.949308 .
3.Lien-Hung Huang, Cheng-Shyuan Rau, Wen-Hong Zeng, Tsu-Hsiang Lu, Yi-Chan Wu, Yi-Hong Chiu, Kai-Ming Wu, Chia-Wen Tsai, Chia-Wei Lin, Chia-Jung Wu, Yi-Chang Chung*, Ching-Hua Hsieh** (2022) " A new technique for separating platelet-rich plasma by a copolymer device— without a centrifugation process" Biomedicine & Pharmacotherapy 153; 113481.

# Development of some skin-related biomaterials

**Kai-Ming Wu[1], Jung-Chang Chung[1], Shi-Han Kao[2], Te-Yu Tsao[2], Jui-Yang Chan[2], Yi-Chang Chung[1,2*]**

[1] Research Center of Biomimetic and Medicare Technology, National University of Kaohsiung, Kaohsiung, Taiwan
[2] Department of Chemical and Materials Engineering, Institute of Biomedical Engineering, National University of Kaohsiung, Kaohsiung, Taiwan

**Abstract**

The skin, the largest organ in our body, plays a crucial role in communicating with external stimuli, acting as a barrier against pathogens (such as viruses and bacteria), and transporting metabolites out of the body. As such, the skin serves as a fundamental, accessible, and initial basis for the design of biomaterials. Here, we introduce recent developments in skin-related biomaterials from our laboratory.

Skin patches have diverse applications, including pain relief, scar treatment, skin fixation, and wearable devices. However, common issues include allergic reactions, discomfort from residual adhesives, and loss of adhesion after contact with water. Traditional skin adhesives, composed of complex mixtures of sticky polymers, oligomers, and small molecules, often present these problems. In this study, we have developed silicone adhesives to create stress-relief skin patches for long-term adhesion and promising uses in the inhibition of keloids and hypertrophic scars. Modifications to the silicone formulation, combined with an acrylic adhesive layer (bilayer structure), make it a suitable candidate for securing wearable and medical devices, such as non-tied oxygen masks, eye masks, medical tubing, and continuous glucose monitors.

Additionally, we have developed a fast-forming silicone glue that creates a thin protective film over scar areas. This silicone layer functions as a substitute for the dermal layer, supporting oxygen transmission and regulating water loss. We have incorporated antioxidants, such as liposomal gallic acid (GA), into the silicone glue for transdermal effects, including scar inhibition. GA also demonstrates antibacterial and wound-healing properties.

Our research also focuses on developing specific skin patches integrated with wearable devices. We have designed a conductive dry electrode using carbon nanotubes dispersed in silicone glue, which offers a more robust but flexible structure, consistent measurements, and reduced sensitivity to environmental humidity compared to traditional ionic hydrogel electrodes. Another skin sensor using laser-induced graphene techniques to fabricate a conductive silicone patch has been developed for training small muscle motions. Moreover, a piezoelectric stimulation and battery-free sensor is being developed for epidermal stimulation on ear skin, potentially serving as a promising biosensor.

The biocompatibility and specific effects of these materials in interaction with skin and related cells have been thoroughly studied to evaluate their biosafety and functionality. We anticipate the practical application of these materials and products in the near future.

# Biomaterials & Tissue Engineering 講座-主題演講者-林峯輝

2024年8月16日 星期五 (8:45-9:45)

*化工系館 202*

**Feng-Huei Lin, Tenure Distinguished Professor**

**Current Position**

- Investigator, Institute of Biomed Eng & Nanomed., National Health Research Institutes (NHRI), Taiwan
- Tenure Distinguished Prof., Inst. of Biomed. Eng., National Taiwan University (NTU), Taiwan

**Experiences**

- 2014/08-, 2023/09, Director, Institute of Biomed Eng & Nanomed., National Health Research Institutes (NHRI), Taiwan
- 2012/08-, Tenure Distinguished Prof., Inst. of Biomed.Eng., National Taiwan University (NTU)
- 2017/08-, Executive Yuan Member, Science & Technology Program Executive Review Board, Adjunct Research Fellow office of Ministry Science and Technology, Executive Yuan.
- 2016/08-2017/07- Lecture Professor, Institute of Technology National United University

**Academic Qualifications**

- Dept. Mater. Sci., National Cheng-Kung University, Taiwan
Ph.D., 1985/09~1989/11, Institute of Materials Sciences, Biomaterials
- Dept. Mater. Sci., National Cheng-Kung University, Taiwan
Master, 1983/09~1985/06, Institute of Materials, Biomaterials
- Dept. Earth Sci., National Cheng-Kung University, Taiwan
Bachelor, 1976/10~1980/06, Dept Earth Science

**Award(s) and honor(s)**

1. Excellent Teaching Award, National Taiwan University(2000、2003、2009、2010、2011)
2. Outstanding Teaching Award, National Taiwan University(2004、2012)
3. Outstanding Research Award, Ministry of Science and Technology, R.O.C(2004、2010、2015)
4. Outstanding Research Award, National Taiwan University(2005、2011、2016)
5. Taiwan Medicine Society, Dr. Cong-Ming Tu Outstanding Research Award(2008)
6. Fellow, International College of Biomaterials Science and Engineering (IFBMSEC 2012)
7. 2013 Outstanding Professor or Engineering, Chinese Society of Engineering, Taiwan
8. Far Eastern Y.Z Hsu Science and Technology Memorial Foundation of Lecture Professor (2013)
9. International Fellow, World Federation of Preventive & Regenerative Medicine (WFPRM 2014)
10. International Fellow, International Society of Blood Biomaterials (ISBB 2016)
11. Distinguished Administrative Service Contributions, National Health Research Institute (2017)
12. Fellow, American Institute for Medical and Biological Engineering (AIMBE 2018)
13. Outstanding Research Achievement Award of National Health Research Institutes (NHRI 2019)
14. Chau-Jean Lee Biomedical Engineering Award, Society of Biomaterials & Control Release (2019)
15. Outstanding Research. Achievement & Contribute Award, Wang Ming-Ning Mem. Foundation (2020)
16. Distinguished Alumni Award of National Cheng Kung University (2022)
17. The Fellow of the Society of The Materials Research Society-Taiwan (2023)



Publications
over 500 SCI papers (since 1992) and 11 book chapters in biomaterials
Specialties
Biomaterials, Tissue Engineering, Regenerative Medicine

**Iron-doped Calcium Sulfide Magnetic Nanoparticles as Thermoseeds for Hyperthermia**

**Author 吳岳修[1], Author (林峯輝)[1*]**

[1] Affliation (國立臺灣大學 醫學工程研究、財團法人國家衛生研究院生醫工程與奈米醫學研究所)
E-mail: double@ntu.edu.tw; email of the corresponding author

In this study, a magnetic iron-doped calcium sulfide (Fe-CaS) nanoparticle was newly developed and studied for the purpose of hyperthermia due to its promising magnetic property, adequate biodegradation rate and relatively good biocompatibility. Fe-CaS nanoparticles were synthesized by a wet chemical co-precipitation process with heat treatment in an N2 atmosphere, and were subsequently cooled in N2 and exposured to air at a low temperature. The crystal structure of the Fe-CaS nanoparticles was similar to that of the CaS, which was identified by an X-ray diffractometer (XRD). The particle size was less than 40 nm based on a Debye-Scherrer equation and transmission electron microscope (TEM) examination. Magnetic properties obtained from the SQUID magnetometer demonstrated that the synthesized CaS was a diamagnetic property. The area of the hysteresis loop increased with the increasing of the treated temperature, especially at 800°C for 1 hour. This is because more Fe ions replaced Ca ions in the lattice at the higher heat treatment temperature. The heat production was also increasing with the increasing of heat treatment temperature, which resulted in an adequate specific absorption ratio (SAR) value, which was found to be 45.47 W/g at 37°C under an alternative magnetic field of f = 750 KHz, H = 10 Oe.
The in vitro biocompatibility test of the synthesized Fe-CaS nanoparticles examined by the LDH assay showed no cytotoxicity to 3T3 fibroblast. The result of in vitro cell hyperthermia shows that under magnetic field the Fe-CaS nanoparticles were able to generate heat and kill the CT-26 cancer cells significantly. Furthermore, the sulfide-based magnetic Fe-doped CaS nanoparticles modified with a silica layer were then investigated. A polyvinyl pyrrolidone polymer was used as the coupling agent. The developed nanoparticles contained 11.6 wt% iron concentration, and their x-ray diffraction pattern was similar to those of CaS and Fe-CaS nanoparticles. In the animal study, tumor-bearing Balb/c mice were subcutaneously injected with nanoparticles and exposed to an AC magnetic field manifested a reduction in tumor volume. The newly developed Fe-CaS nanoparticles and silica-modified Fe-CaS nanoparticles can thus be considered a promising and attractive hyperthermia thermoset.

**References:**

Keywords: Hyperthermia · Iron-doped · Calcium Sulfide · Nanomedicine · Magnetic nanoparticles

# 免疫治療遞送講座-主題演講者-胡哲銘

2024年8月16日 星期五 (10:00-12:00)

*化工系館 210*

**Che-Ming Jack Hu, Associate Research Fellow**

**Current Position**

Associate Research Fellow. Institute of Biomedical Sciences, Academia Sinica, Taiwan

**Academic Qualifications**

•Ph. D. in Bioengineering, UC San Diego, USA (09/2006 – 12/2011)
•B.S. in Biomedical Engineering, UC Berkeley, USA (08/2001 – 05/2005)

**Current Position & Employment History**

•Associate Research Fellow 10/2019 – Present
- Institute of Biomedical Sciences, Academia Sinica, Taiwan
Assistant Research Fellow 06/2015 – 09/2019
- Institute of Biomedical Sciences, Academia Sinica, Taiwan
Postdoctoral Research Fellow 01/2012 – 05/2015
- Department of Nanoengineering, UC San Diego, USA

**Scientific Awards**

**2023** Moderna Taiwan mRNA Innovation Award (莫德納台灣mRNA前瞻新創獎)
**2023** Outstanding Research Award, National Science and Technology Council, Taiwan (國家科學及技術委員會傑出研究獎)
**2022** Outstanding Technology Award by the Taiwan Nanomedicine Society (台灣奈米生醫學會傑出技術獎)
**2022** The 10th Y.Z. Hsu Technology Invention Award—Biomedical Technology (有庠科技發明獎)
**2021** Academia Sinica Early-Career Investigator Research Achievement Award (年輕學者研究成果獎)
**2020** Chen-Yuan Lee Foundation Young Investigator Award in Biomedical Research (李鎮源教授青年研究學者獎)
2016

**Biography Brief**

Dr. Hu is currently an Associate Research Fellow at the Institute of Biomedical Sciences, Academia Sinica, Taiwan. Her research focuses on biomaterials, drug delivery, and vaccine nanotechnology. Her current research includes the development of emerging applications for intracellular polymerization technology and asymmetrically stabilized nanocarriers. He has addressed fundamental barriers in nanocurvature stabilization, which enables versatile nanoparticle designs with combinatorial and macromolecular cargoes. He is focused on enabling safer gene delivery carriers and more advanced cancer immunotherapeutics using the nanotechnology.

**Selected Publications**

1.Tsai H-H, Huan P-H, Lin CW, Yao B-Y, Liao W-T, Pai C-H, Liu Y-H, Chen H-W*, **Hu C-M***. Lymph node follicle-targeting STING agonist nanoshells enable single-shot M2e vaccination for broad and durable influenza protection, ***Advanced Science***, **2023**, 2206521.
2.Chien C-Y, Lin J-C, Huang C-Y, Hsu C-Y, Yang K-C, Chattopadhyay S, Nikoloutsos N, Hsieh P, Hu C-M*. In situ hydrogelation of cellular monolayers enables conformal biomembrane functionalization for xeno-free feeder substrate engineering. ***Advanced Healthcare Materials***, **2022**, 2201708.
3.Lin J-C, Hsu C-Y, Chen J-Y, Fang Z-S, Chen H-W, Yao B-Y, Shiau GHM, Tsai J-S, Gu M, Jung M, Lee T-Y, **Hu C-M*** Facile transformation of murine and human primary dendritic cells into robust and modular artificial antigen-presenting systems by intracellular hydrogelation. ***Advanced Materials***, 2021, 2101190.

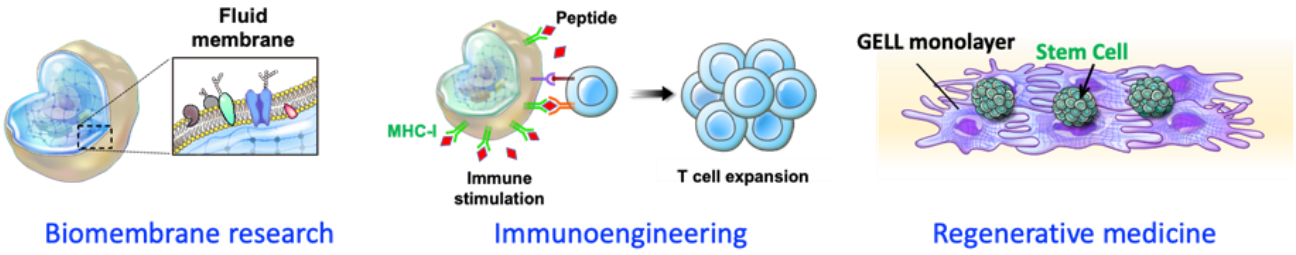
# Enhancing adoptive therapy and antigen-specific T cell identification with cellular polymerization technology

Che-Ming Jack Hu[1*]

[1]Institute of Biomedical Sciences, Academia Sinica, Taiwan
*E-mail chu@ibms.sinica.edu.tw

Identifying and capturing antigen-specific T cells from patient samples have immense scientific and therapeutic values in antiviral and anticancer research. However, T cell capture specificity is limited by the comparatively low affinity between pMHC complexes and T cell receptors (TCR). We developed a rapid photochemistry that enables intracellular hydrogel polymerization of living cells for the generation of a biomimetic T cell capture probe. The polymerized cells retain the integrity of its plasma membrane bilayer and mobile surface proteins for biological engagement, and their polymerized interior confers extraordinary stability and long-term storability. We demonstrate the applicability of the biomimetic probe to capture rare tumor-specific and virus-specific T cells from blood samples. In addition, we show T cell captured from the biomimetic probe are highly potent in anticancer adoptive T cell therapy. The cellular polymerization technology is also shown to enhance T cell expansion[1] and can be adopted for other purposes such as feeder cell engineering[2], rapid membrane vesicle derivation, and synthetic biology[3], offering a unique toolset for biomedical applications and immunoengineering.

**KEYWORDS**: intracellular polymerization, radical polymerization, biomimicry, immunotherapy, tissue engineering, biomembrane.




Graphic abstract

[1] Lin J-C, Hsu C-Y, Chen J-Y, Fang Z-S, Chen H-W, Yao B-Y, Shiau GHM, Tsai J-S, Gu M, Jung M, Lee T-Y, **Hu C-M*** Facile transformation of murine and human primary dendritic cells into robust and modular artificial antigen-presenting systems by intracellular hydrogelation. ***Advanced Materials***, 2021, 2101190.

[2] Chien C-Y, Lin J-C, Huang C-Y, Hsu C-Y, Yang K-C, Chattopadhyay S, Nikoloutsos N, Hsieh P, **Hu C-M***. In situ hydrogelation of cellular monolayers enables conformal biomembrane functionalization for xeno-free feeder substrate engineering. ***Advanced Healthcare Materials***, 2022, 2201708.

[3] Contreras-Llano L, Liu Y-H, Henson T, Meyer C, Baghdasaryan O, Khan S, Lin C-L, Wang A, **Hu C-M***, Tan C*. Engineering cyborg bacteria through intracellular hydrogelation. ***Advanced Science***, 2023, 2204175.

# 穿戴式生醫感測技術講座-主題演講者-林宗宏

2024年8月16日 星期五 (8:45-9:45)

*化工系館 210*

**Zong-Hong Lin, Professor**

**Current Position**

Professor. Department of Biomedical Engineering, National Taiwan University, Taiwan

**Academic Qualifications**

•Ph. D. in Department of Chemistry, National Taiwan University, Taiwan (09/2005 – 06/2009)
•M.S. in Department of Chemistry and Biochemistry, National Chung Cheng University, Taiwan (09/2003 – 06/2005)
•B.S. in Department of Chemistry and Biochemistry, National Chung Cheng University, Taiwan (09/1999 – 06/2003)

**Current Position & Employment History**

•Professor 02/2023 – Present
- Department of Biomedical Engineering, National Taiwan University, Taiwan
Professor/ Associate Professor/ Assistant Professor 08/2014 – 01/2023
- Institute of Biomedical Engineering, National Tsing Hua University, Taiwan
Postdoctoral Research Fellow 04/2012 – 07/2014
- School of Materials Science and Engineering, Georgia Institute of Technology, USA

**Scientific Awards**

•NSTC Outstanding Research Award 2024
•NTU 校拔萃講座 and 工學院學術勵進獎 2023
•NSTC Ta-You Wu Memorial Award 2021
•NSTC Future Tech Award 2021、2022、2023
•NTHU 校 and 工學院新進人員研究獎 2017

**Biography Brief**

Dr. Lin is currently a Professor at the Department of Biomedical Engineering, National Taiwan University. His research interests include the development of self-powered (bio)chemical sensors, biomedical diagnostic devices, wearable healthcare electronics and remote intelligent monitoring platform, micro- and nano-nanogenerators/materials for bioelectrical stimulation applications. He has published more than 150 SCI papers (sum of the times cited: 15210, h-index: 60).

**Selected Publications**

1.S. R. Barman, Y.-J. Lin, K.-M. Lee, A. Pal, N. Tiwari, S. Lee; Z.-H. Lin* (2023) "Triboelectric Nanosensor Integrated with Robotic Platform for Self-Powered Detection of Chemical Analytes" **ACS Nano**, 17, 3, 2689-2701 **(Headline Science Video)** (IF: 17.1; Rank: 20/344, MATERIALS SCIENCE, MULTIDISCIPLINARY).
2.S. R. Barman, S.-W. Chan, F.-C. Kao, H.-Y. Ho, I. Khan, A. Pal, C.-C. Huang, Z.-H. Lin* (2023) "A Self-powered Multifunctional Dressing for Active Infection Prevention and Accelerated Wound Healing" **Sci. Adv.**, 9, eadc8758 (IF: 13.6; Rank: 7/73, MULTIDISCIPLINARY SCIENCES).
3.Y.-J. Lin†, I. Khan†, S. Saha, C.-C. Wu, S. R. Barman, F.-C. Kao, Z.-H. Lin* (2021) "Thermocatalytic Hydrogen Peroxide Generation and Environmental Disinfection by $Bi_2Te_3$ Nanoplates" **Nat. Commun.**, 12, 180 **(Editor's Highlight)** (IF: 17.694; Rank: 6/73, MULTIDISCIPLINARY SCIENCES).

# Thermosensitive Smart Robotic Self-Powered Sensor for Material Identification

**Zong-Hong Lin***

Department of Biomedical Engineering, National Taiwan University, Taipei City, Taiwan
Email of corresponding author: zhlin@ntu.edu.tw

In the swiftly evolving landscape of robotics and AI-based systems, the demand for advanced multifunctional sensors has surged, driven by the need to enable efficient and targeted functionalities. The emergence of triboelectric sensors presents promising avenues to address these challenges. This study introduces an innovative approach by integrating smart thermosensitive triboelectric nanosensors onto a robotic platform, facilitating material recognition through the contact electrification process. Equipped with self-powered tactile awareness, the robotic fingers enhance user safety while elevating material identification accuracy through the "touch and sense" mechanism. The sensor is designed with micro pyramidal structures in Ecoflex-based encapsulation layers, with NaCl solution serving as the electrolyte conductor. This configuration enhances stretchability and sustains prolonged sensitivity. Moreover, due to the multifunctional sensing capability of the self-powered thermosensitive sensors, they can be utilized in bionic prosthesis systems as receptors. The direct integration of robotics with self-powered thermosensitive sensors can be employed as cost-effective automated sensing, aiding material identification.

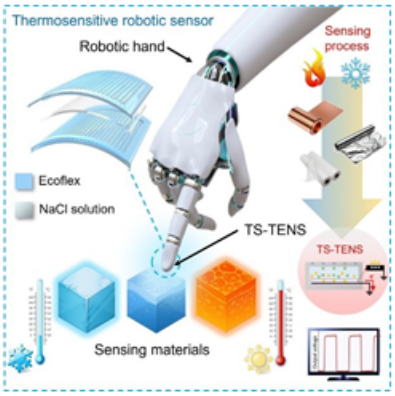



**Figure 1. Robotic hand-based thermosensitive triboelectric nanosensor for highly sensitive material identification.**

**Keywords:** triboelectric, material identification, thermosensitive, robotic hand, self-powered sensor

## References

1.A. Pal†, K. C. Lim†, S.-W. Chen, Y.-T. Huang, P. Parashar, A. Ganguly, Y.-H. Chen, K.-P. Fan, L.-C. Shen, J. Cheng,* Z.-H. Lin* (2024) **DEVICE**, Accepted (DEVICE-D-23-00207).
2.A. Pal, A. Ganguly, P.-H. Wei, S. R. Barman, C.-C. Chang, Z.-H. Lin* (2024) **Advanced Science**, 11, 2307266.

# IADDS-產學論壇講者- Heidi Wang

2024年8月15日 星期四 (13:20-15:20)

*化工系館202*

**Heidi Wang, M.S., Ph.D.**

Chief Executive Officer

**AREAS OF EXPERTISE**

Dr. Heidi Wang is an experienced global regulatory and drug development expert with 30+ years of Pharmaceutical Industry and Biotech experience. With expertise in Oncology, Virology, Immunology, and other therapeutic areas, Heidi led and contributed to shaping strategy and delivering approvals for Bristol Myers Squibb Company (BMS) and now, for OBI Pharma. Importantly, Heidi's positive leadership style and inclusive mindset helped to transform both company's culture and processes to optimize their portfolio acceleration and to bring people together. Leveraging her strengths in problem solving, risk mitigation, and asking the right questions, coupled with a deep expertise in drug development, Heidi is now guiding OBI Pharma and as a Board member of 2 companies and her alma mater, Fu-Jen University. She volunteers as an advisor and mentor to individuals and multiple organizations in the US and Taiwan.

# Challenges and Opportunities of ADC Drug Development

**Heidi Wang, Ph. D.**[1]

[1] OBI Pharma Inc.
E-mail: info@obipharma.com

**ABSTRACT**

Antibody–drug conjugates (ADCs) are targeted immunoconjugate molecules that integrate the potency of cytotoxic drugs with the selectivity of monoclonal antibodies while minimizing damage to healthy cells and reducing systemic toxicity. Their design allows for higher doses of the cytotoxic drug to be administered, potentially increasing efficacy. ADCs are currently among the most promising drug modalities in the fight against cancer, with efforts to expand their applications for non-oncological indications and in combination therapies.

Despite successes in the past 20 years, development of effective ADCs with broad therapeutic window remains challenging due to the complexity of conjugation technologies and the instability of the linkers.

In this presentation, I will describe the challenges and opportunities of developing the next generation of ADCs. Considerations from CMC/manufacturing, preclinical, and clinical will be interwoven with relevant guidance from major health authorities.

# IADDS-產學論壇講者- Pei Kan

2024年8月15日 星期四 (13:20-15:20)

*化工系館202*

**Pei Kan, PhD**

**Current Position**
Cofounder & President, Pharmosa Biopharm Inc., Taiwan

**Biography Brief**

Dr. Pei Kan graduated from National Tsinghua University in Taiwan and completed post-doctoral research at Tsukuba University in Japan.

He has worked in the pharmaceutical industry for more than 20 years, focused on formulation technology and product development, published over 50 papers and more than 20 patents related to drug delivery. He has led the development of several new formulation-based drug projects and completed filing and listing of IND, BioIND, and ANDA products in Taiwan, China, United States, Japan, and Europe. He served as a researcher at Industrial Technology Research Institute (ITRI), then an associate director of Taiwan Liposomal Company. He cofounds Pharmosa Biopharm Inc. and serves as president and executive direct of the company.

**Selected Publications**

P Kan, et al., Extended pulmonary retention of inhaled liposomal treprostinil (L606) correlated with pharmacodynamics and plasma pharmacokinetics. Am J Respir Crit Care Med (2023) 207:A3782.

P. Kan, et al., A liposomal formulation able to incorporate a high content of paclitaxel and exert promising anticancer effect. J Drug Deliv (2011) 2011:629234.

P Kan, et al., Thermogelling emulsions for vascular embolization and sustained release of drugs. J Biomed Mater Res (2005) 75(1):185-92.

P Kan, et al., Perfusion of medium with supplemented growth factors changes metabolic activities and cell morphology of hepatocyte /non-parenchymal cell co-culture. Tissue Eng (2004) 10 (9-10): 1297-1307.

P Kan, et al., Prediction of phase equilibrium for aqueous two-phase systems by a neural network model. IEC Research (1996) 35(6), 2015-2023.

# Inhaled Liposome-Device Combination for Self-Administration at Home

**Pei Kan (甘霈), Cathy Chen (陳可潔), Frank Liang (梁祥發)**

Pharmosa Biopharm Inc. (國邑藥品科技)
E-mail: ir@pharmosa.com.tw

**ABSTRACT**

Inhalation medicine, administered by device into lungs, is a direct and efficient method for drug delivery. However, most of the devices are not use-friendly for at-home use. Device compliance (adherence) is always a concern for clinical effectiveness, especially while drug has a short half-life. In addition, increasing dose frequency deteriorates the situation.

Pharmosa has developed two extended-release liposome formulations combined with advanced devices to address key challenges in inhalation medicine. These formulations aim to reduce irritation of upper airway, prolong a stable drug exposure at target site and improve patent's compliance. L606 is intended to deliver Treprostinil locally to pulmonary vasculature for treating Group 1 pulmonary arterial hypertension (G1 PAH) and Group 3 pulmonary hypertension associated with interstitial lung disease (G3 PH-ILD). L608 seeks to replace clinic infusion with home inhalation, providing prolonged stable systemic exposure. The two products are currently ongoing Phase 3 and Phase 1 studies in the US and Australia, respectively.

**References:**

[1] A Phase 3, 2-part, Open-label, Multicenter Study to Evaluate the Safety, and Efficacy of Liposomal Treprostinil Inhalation Suspension (I606) in Subjects With Pulmonary Arterial Hypertension (PAH) and Pulmonary Hypertension Associated With Interstitial Lung Disease (PH-ILD). American Journal of Respiratory and Critical Care Medicine (2024) 209: A7368.

[2] Extended Release of Inhaled Iloprost Liposome (L608) for Treatment of Systemic Sclerosis-Related Raynaud Phenomena and Digital Ulcer. Annals of the Rheumatic Diseases (2024) 83: 1916.

# IADDS-產學論壇講者-Dar-Jen, Hsieh

2024年8月15日 星期四 (13:20-15:20)

*化工系館202*

**Dar-Jen (DJ) Hsieh**
Affiliation: Founder and CEO, ACRO Biomedical Co., Ltd.
E-mail: dj@acrobiomedical.com

**Education**

PhD, Cell and Molecular Biology, State University of NY at Buffalo, USA. 1994
BS, Dept. of Microbiology, Soochow University, 1985

**Experience**

| | |
|---|---|
| CEO, Sunmax Biotechnology Co., Ltd. | 2009-2014 |
| Deputy CEO, IBMI | 2007-2009 |
| CEO, PRIT Biotech Co., Ltd. | 2004-2006 |
| Researcher and Director of BD, ATIT | 2003-2004 |
| CEO, Acrobio Consultant Co., Ltd. | 2000-2003 |
| VP of Technology, Formosa Biotech Inc. | 1997-2000 |
| Associate Professor, Dept. Biology and Institute of Medical Research, KMU | 1995-1997 |

**Current Research Fields**

Tissue Engineering and Regenerative Medicine
Biomaterials from animal tissues and organs decellularized by supercritical CO2

**Award and honor**

72 international patents granted
21 published research articles using supercritical CO2
Numerous awards from Biopharma society.
Best platform technology, 2022 Taiwan Biopharma Award, AWAPAC

Dr. Dar-Jen Hsieh founded ACRO Biomedical Co., Ltd. in June 2014. The company is in the leading position in the field of collagen-derived medical devices that are experts in tissue engineering and regenerative medicine of human tissues and organs. Dr. Hsieh received his PhD in Cell and Molecular Biology from the State University of New York at Buffalo. He has years of experience in the biotechnology and healthcare field and has held industrial, governmental, and academic positions.

# $SCCO_2$-Decellularized Kidney Scaffold for *In vivo* Kidney Regeneration

**Srinivasan Periasamy (史瑞尼)[1], Yin-Chih Fu[2](傅尹志), Dar-Jen Hsieh (謝達仁)[1*]**

[1] RD Center, ACRO Biomedical Co., Ltd. (亞果生醫股份有限公司)

[2] Kaohsiung Municipal Ta-Tung Hospital, Kaohsiung Medical University (高雄醫學大學)

E-mail: dj@acrobiomedical.com

**ABSTRACT**

Chronic kidney disease (CKD) patients incidence remains to increase worldwide. CKD has become a progressively important health problem. In end-stage kidney disease (ESKD), renal replacement therapy, comprising hemodialysis, peritoneal dialysis, and renal transplantation, is essential. In 2010, 2.61 million people received dialysis or kidney transplantation, and it is projected that the number will be two-fold by 2030. Kidney transplant is done only in a small number of patients due to the shortage of donated kidneys. Kidney transplantations (KT) worldwide in 2019 as per the World Health Organization (WHO) report were 100,097, which was 4.8% higher than the previous year. Thus, the establishment of renal regeneration therapy is important, and strategies using stem cells might be one of the potential options to achieve this. In this study, we applied a supercritical $CO_2$ extraction technology to remove all the immunogen from rabbit kidneys, leaving the intact kidney scaffold for *in vivo* transplantation to live rabbits. The transplanted kidney was harvested after four weeks and urine was detected within the reconstructed kidney by nuclear medicine imaging. Histological analysis revealed CD34+ stem cells from the host rabbit repopulated in the kidney scaffold and differentiated into various cell types as shown by immunohistochemical staining using different cell differentiation markers including Pax2, WT1, Pax8, CK, CK7, which indicated the *in vivo* regeneration of kidney with partial biological function. The large animal model was also done using pig-to-pig kidney transplantation. We believe this is the first *in vivo* organ reconstruction approach with tremendous potential to solve the global shortage of organs.

**References:**

[1] Hsieh DJ, Srinivasan P, Yen KC, Yeh YC, Chen YJ, Wang HC, Tarng YW. Protocols for the preparation and characterization of decellularized tissue and organ scaffolds for tissue engineering. Biotechniques. 2021 Feb;70(2):107-115

[2] Srinivasan P & Hsieh D-J. Supercritical Carbon Dioxide Facilitated Collagen Scaffold Production for Tissue Engineering. DOI: 10.5772/intechopen.102438. 2022; 1-22.

Changed to partial from practical

# IADDS-產學論壇講者- Cheng-Hsien Wu

2024年8月15日 星期四 (13:20-15:20)

*化工系館202*

**Cheng-Hsien Cedric Wu, Ph.D.**

Phone: 650-395-8586 (Cell)
Email: chenghsien.wu17@gmail.com
Profile: https://www.linkedin.com/in/cedric-wu-a2a3a125

**PROFILE**

An experienced R&D head in the preclinical life science industry. A hardcore innovator in high-throughput nucleic acid synthesis and its applications. A technology development expert in three high-density DNA/RNA microarray synthesis platforms using "light-directed method", 'inject printing", or "semiconductor microelectronics" enabling high throughput synthesis of single/ double stranded, linear/ circular DNA, RNA, and mRNA API. Leading and managing cross-functional R&D and production teams comprised of experts in microbiology, protein, cellular biology, RNA biology, nucleic acid chemistry, organic chemistry, analytical chemistry, bioinformatics, electrical engineering, software/firmware engineering, semiconductor engineering, mechanical engineering and automation to design, initiate, develop new technologies, products, and services for synthetic sgRNA, gene-editing payload, gene fragment ultra-long synthetic DNA (200kb), plasmids, variant libraries, combinatorial DNA libraries, DNA microarray, DNA synthesizer, high complex oligo libraries (8.4M), semiconductor chip-based molecular diagnostics, digital microfluidics, DNA data storage, NGS sample prep and target enrichment kits, along with mRNA, circRNA API and formulation. Published 40+ patent applications and filed numerous trade secrets in manufacturing lines.

# Optimizing RNA Manufacturing for Rapid RNA Therapeutic Development

**Cheng-Hsien Cedric Wu (吳政憲)[1]**

[1] GenScript USA, Inc (美國金斯瑞生物科技公司)
E-mail: cedric.wu@genscript.com

## ABSTRACT

Recent advancements in RNA therapeutics have underscored the need for mRNA molecules with enhanced stability and functionality *in vivo*. However, the supply of RNA active pharmaceutical ingredients (API) has become a significant bottleneck, hindering progress in the field. In this study, we present novel methods and streamlined manufacturing processes for producing high-performance mRNA, self-amplifying RNA, and circular RNA. Our approach addresses current bottlenecks by achieving significant improvements in capping efficiency, circularization yield, and integrity.

Beyond manufacturing, we also emphasize the importance of sequence design, untranslated regions (UTRs), internal ribosome entry sites (IREs), codon optimization, chemical modifications, and delivery formulations for optimal efficacy. Leveraging our expertise, we have developed a comprehensive sequence-to-vial service. We demonstrate that mRNA-encoded Cas9, Cas12a, and prime editing exhibit comparable gene editing efficiencies to their protein counterparts in both *in vitro* and *in vivo* settings, with the added benefits of ease of preparation and scalability. Our advancements pave the way for the development of more efficacious and readily available RNA therapeutics.

# IADDS-邀請演講者- Pin-Kuang Lai

2024年8月15日 星期四 (15:40-17:10)

*化工系館202*

**Charles Pin-Kuang Lai, Associate Research Fellow**

Current Position
Associate Research Fellow. Institute of Atomic and Molecular Sciences, Academia Sinica, Taiwan

**Brief Biography**

Dr. Charles Lai is an Associate Research Fellow at the Institute of Atomic and Molecular Sciences, Academia Sinica, Taiwan. His research focuses on developing molecular bioimaging tools with unprecedented spatiotemporal accuracy to investigate biological phenomena, including bionanoparticles (extracellular vesicles; exosomes) and DNA repairs. Dr. Lai's bioimaging systems have since been adopted by more than 50 laboratories worldwide, advancing research across various disciplines, including cancer biology, bioengineering, and therapeutics development. His work has been published in top tier journals such as *ACS Nano, Advanced Materials, Advanced Sciences, Nature Communications, Nature Protocols,* and *Nucleic Acids Research*.

**Selected Publications**

1.Magoling, B., et al., **Lai, C.P.*** (2023). Membrane protein modification modulates big and small extracellular vesicle biodistribution and tumorigenic potential in breast cancers in vivo. ***Advanced Materials.*** 35(13): e2208966.
2.Wu, A.Y., et al., **Lai, C.P.*** (2020). Multiresolution imaging using bioluminescence resonance energy transfer identifies distinct biodistribution profiles of extracellular vesicles and exomeres with redirected tropism. ***Advanced Science.*** 7(19): 2001467-83.
3.Chien J.C., et al., Badr C.E.*, **Lai, C.P.*** (2020). Multiplexed bioluminescent reporter enables real-time tracking of DNA double strand break repair dynamics in vitro and in vivo. ***Nucleic Acids Research.*** 48 (17): e100-117. *Co-last authors.

# Untangling the Networks of Big and Small Cancer Extracellular Vesicles

**Charles Pin-Kuang Lai (賴品光)**[1,2,3]

*1.Institute of Atomic and Molecular Sciences, Academia Sinica, Taipei, 10617 Taiwan* (中央研究院，原子與分子科學研究所)

*2.Chemical Biology and Molecular Biophysics Program, TIGP, Academia Sinica, Taipei, 11529 Taiwan* (中央研究院，國際研究生學程，生物化學暨分子生物物理學程);

*3.Genome and Systems Biology Degree Program, National Taiwan University, Taipei, 10617 Taiwan* (國立台灣大學，基因體與系統生物學學位學程)

E-mail: laicharles@sinica.edu.tw

Extracellular vesicles (EVs) are cell-derived bionanoparticles that transfer bioactive materials like nucleic acids and proteins, mediating intercellular communication under various (patho)physiological conditions. EVs are heterogenous in nature, and can be categorized by size into small EVs (sEVs; <200 nm) and big EVs (bEVs; >200 nm). While most studies have concentrated on sEVs, our recent research indicates that aggressive breast cancer cells abundantly release bEVs, which show unique biodistribution patterns and carry tumorigenic potential, similar to sEVs. This suggests that cells might utilize multiple EV types for biological functions. However, the concurrent tracking of different EV subpopulations, particularly *in vivo*, remains challenging due to methodological limitations. We introduce the PalmSORBET system, featuring spectrally distinct, multiplexed EV reporters based on Soret band excitation and bioluminescence resonance energy transfer (BRET). The system includes a novel near-infrared BRET reporter, PalmSORET, alongside the established PalmGRET. PalmGRET combines a palmitoylated EGFP with nanoluciferase (Nluc), while PalmSORET links palmitoylated iRFP713 with Rluc8.6-535SG. This multiplexing allows for the simultaneous tracking of bEVs and sEVs using bioluminescence, BRET-mediated fluorescence, and direct fluorescence, providing multi-resolution capabilities. The PalmSORBET system can detect both bEVs and sEVs within a mixture, achieving detection limits of 100 ng *in vitro* and 10 µg *in vivo*. This enables detailed in vivo biodistribution analysis of co-administered bEVs and sEVs, offering new insights into EV subpopulation dynamics. Current efforts focus on investigating the possible interplay in biodistribution among the EV subpopulations. Insights from the PalmSORBET system are expected to deepen our understanding of the role of different EVs in cell-to-cell communication and their implications in basic biology, diagnostics, and therapy.

# IADDS-邀請演講者- Fan-Gang Tseng

2024年8月15日 星期四 (13:20-15:20)

*化工系館210*

**Fan-Gang Tseng, Distinguished Professor**

Current Position
Distinguished Professor, Department of Engineering and System Science, National Tsing Hua University, Taiwan

**Biography Brief**

Dr. Fan-Gang Tseng is currently a distinguished professor with ESS Dept. as well as NEMS Institute at NTHU since 2014. His research interests are in the fields of BioNEMS, Biosensors, Micro-Fluidics, Organ on a Chip, Nano Hydrogen Storage, and Fuel Cells. He received 60 patents, wrote 10 book chapters, published more than SCI 310 Journal papers and 360 conference technical papers with a H-index 44 and more than 8465 citations in google scholar. He received several awards, including, MOST Shakelton Scholar (2019-2021), National Innovation Awards (2010, 2014, 2020), MOST Outstanding in research awards (2010, 2014), Y.Z. Hsu Scientific Paper Award (2014), MOST Mr. Wu, Da-Yo Memorial Award (2006), and more than twenty best papers and other awards in various international conferences and competitions.

**Selected Publications**

1.Ashish Kumar, et.al., "Ru(dpp)3]Cl2-Embedded Oxygen Nano Polymeric Sensors: A Promising Tool for Monitoring Intracellular and Intratumoral Oxygen Gradients with High Quantum Yield and Long Lifetime" *Small,* 2307955.,Dec 2023.

2.Yun-Jie Hao, et. al. "The rare circulating tumor microemboli as a biomarker contributes to predicting early colorectal cancer recurrences after medical treatment" *Translational Research*, 8 August 2023.

3.Wei-Jen Chan , et. al., "Engineering a potent boron-10-enriched polymeric nanoparticle for boron neutron capture therapy" *Nanomedicine*, Apr;18(9):743-754, 2023

4.Kuan-Hung Chen, et. al., "A 3D-ACEK/SERS System for Highly Efficient and Selectable Electrokinetic Bacteria Concentration/Detection/ Antibiotic-Susceptibility-Test on Whole Blood" *Biosensors and Bioelectronics*, Volume 197, 113740, 1 FEB 2022

5.Venkanagouda S. Goudar, et. al., "Impact of a Desmoplastic Tumor Microenvironment for Colon Cancer Drug Sensitivity: A study with 3D chimeric tumor spheroids" *ACS Applied Materials & Interfaces*. 13, 41, 8478–48491, OCT, 2021.

# Organ-on-a-chip Models For Cancer Drug Screening And Safety Assessment In Vitro

**曾 繁根Fan-Gang Tseng1,2***

1 國立清華大學工科系,奈微所,化學系
2 中央研究院應科中心
1ESS Dept., Chemistry Dept., NEMS I., National Tsing Hua University, Taiwan R.O.C
2 Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan R.O.C
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ABSTRACT

Despite the recent advancement of biotechnology and pharmaceutical research, cancers remain the leading cause of human mortality. It is vital to diagnose cancers at an early stage when treatment can dramatically improve prognosis. So far, low-cost and easy to operate devices, which allow efficient isolation and sensitive detection of circulating tumor cells (CTCs) for routine blood screening, remain lacking. This talk will introduce a micro fluidic platform (High-Density Self-Assembled-Cell-Array, HD-SACA system)[1] which can not only isolate single CTCs/CTMs from the real blood sample in one hour for rapid CTCs identification and diagnosis, together with a nano particle sensing system, but also conduct Tumor organelle drug screening for precision medicine. This system includes a high throughput 3D Micro-Dialysis and Self Assembled Cell Array (SACA) chip to quickly self-assemble cells into a densed monolayer (106 cells/cm2) for rapid staining and in-parallel inspection at high speed (6x106 cells/1 hour for 4 images). The distinguished ratio can reach 1 to 1 billion, recovery rate more than 95%, and whole process can be finished in two hours for 4 ml blood sample [2]. In this research, we have successfully enumerating CTCs/CTMs by self-assembled cell array (SACA) chip system for more than 1000 patients with diagnosed colorectal cancers and others. We found that the CTC count in PB but not IMV correlates with disease stages. Neoadjuvant chemotherapy did not lead to decreased CTC count in both types of blood samples. With the combination of CTCs/CTMs and other biomarkers, the detection odds ratio can be higher than 21[3,4]. Due to the rapid and gentle process, the on-chip isolated CTCs are still in vital and can be further characterized and cultivated for the identification by using nano sensors for further prognosis by reading the information from cancer microenvironments in the Tumor-organoid on a chip [5]. The cultivated/expanded CTCs on chip, when forming Tumor-organelles, can be further used as drug testing targets to screening combinatory drugs for AI assisted precision medicine [6]. The Tumor-organoid on a chip can be further integrated with Liver-on-a-chip and Kidney-on-a-chip for not only combinatory drug testing, but also drug toxicity validation.

References:
[1] WY Cho et. al., Scientic Reports 7, 11385, 2017.
[2] Gadar, Venkatesh et. al. Sens & Acts B, 2020, TJ Chen et. al, Biomicrofluidics, 2014.
[3]Chu, Hsueh-Yao, et. Al. Cells, 10(5), 1149, 2021
[4]Hao, Yun-Jie, et. al., Translational Medicine, 2023
[5] A. Kumar, et. Al. Small, 2023, M. Prasad, et. al., ACS App. Mat. & Int., 2018.
[6]Yang, Hin-Yu, et. al., Advanced Therapeutics, 2023

# IADDS-邀請演講者- Jin-Wu Tsai

2024年8月15日 星期四 (15:40-17:10)

*化工系館202*

**Jin-Wu Tsai, Distinguished Professor**

Current Position
Distinguished Professor, Institute of Brain Science (IBS), College of Medicine, National Yang Ming Chiao Tung University (NYCU), Taipei, Taiwan

**Biography Brief**

Prof. Jin-Wu Tsai has been using interdisciplinary approaches to understand the cellular and molecular mechanisms in brain development and brain malformation, such as lissencephaly, microcephaly and focal cortical dysplasia (FCD). In recent years, his group invented a transposon-based genetic screening method to further identify novel genes involved in these processes. He has identified key genes and molecular pathways for neural stem cell proliferation and neuronal migration during the development of cerebral cortex.

**Selected Publications**

Tsai MH, Ke HC, Lin WC, Nian FS, Huang CW, Cheng HY, Hsu CH, Granata T, Chang CH, Castellotti B, Lin SY, Doniselli FM, Lu CJ, Franceschetti S, Ragona F, Hou PS, Canafoglia L, Tung CY, Lee MH, Wang WJ, Tsai JW* (2024) Novel lissencephaly-associated NDEL1 variant reveals distinct roles of NDE1 and NDEL1 in nucleokinesis and human cortical malformations. Acta Neuropathol, 147(1):13.

Tsai MH, Muir AM, Wang WJ, Kang YN, Yang KC, Chao NH, Wu MF, Chang YC, Porter BE, Jansen LA, Sebire G, Deconinck N, Fan WL, Su SC, Chung WH, Almanza Fuerte EP, Mehaffey MG, University of Washington Center for Mendelian Genomics, Ng CC, Chan CK, Lim KS, Leventer RJ, Lockhart PJ, Riney K, Damiano JA, Hildebrand MS, Mirzaa GM, Dobyns WB, Berkovic SF, Scheffer IE, Tsai JW*, Mefford HC* (2020) Pathogenic variants in CEP85L cause sporadic and familial posterior predominant lissencephaly. Neuron, 106(2):237-245.

Lu IL, Chen C, Tung CY, Chen HH, Pan JP, Chang CH, Cheng JS, Chen YA, Wang CH, Huang CW, Kang YN, Chang HY, Li LL, Chang KP, Shih YH, Lin CH, Kwan SY, Tsai JW* (2018) Identification of genes associated with cortical malformation using a transposon-mediated somatic mutagenesis screen in mice. Nat Commun, 9(1):2498.

# Mitigating Neuroinflammation and Cognitive Decline in Alzheimer's Disease Using a Novel CSF1R Inhibitor

**Wahyu Dewi Tamayanti1, Agnes Dwi Ariyanti1, Jun-Ru Lin1, Uni Lin1, Tsung Han Hsieh1, Wu-Cheng Ru1, Yenni Chang1, Chuan-Yao Wang1, Chia-Wei Huang1, Hao-Yuan Cheng1, Chi-Yun Pai2, Hung-Kai Chen2*, Jin-Wu Tsai1***

1 Institute of Braiin Science, National Yang Ming Chiao Tung University (國立陽明交通大學腦科學研究所),
2 Elixiron Immunotherapeutics (安立疊榮生醫)
E-mail: tsaijw@nycu.edu.tw , hkchen@elixiron.com

ABSTRACT

Microglial activation is a neuropathological hallmark of Alzheimer's disease (AD), where activated microglia secrete inflammatory cytokines and contribute to neuronal damage and cognitive impairment, thus making microglial modulation an attractive therapeutic strategy. EI-1071 (enrupatinib), a brain-penetrant CSF1R inhibitor, is in clinical development for treating AD. We investigated the pharmacological impacts of EI-1071 on microglial modulation and neuronal functions in the 5xFAD mouse model and evaluated its safety and tolerability in a first-in-human trial. Neurons in 5xFAD mice were marked with EGFP via in utero electroporation, and the mice, with or without EI-1071 treatment, underwent behavioral assessments including Novel Object Recognition (NOR) and Y-maze, followed by microscopic examination of Aβ plaques and GFP-labelled neurons in brain slices. Concurrently, changes in microglial biomarkers were analyzed by quantitative PCR. In a phase 1 trial (NCT04238364) of EI-1071, healthy volunteers received single ascending doses (150, 300, 600, 750, 900 mg, n=34) and multiple ascending doses (600 mg and 750 mg, n=24) to assess the drug's safety and tolerability. Pharmacological inhibition of CSF1R by EI-1071 significantly reduced neuroinflammation and neuronal injuries, with fewer plaque-associated microglia, a declining tendency in amyloid plaques, and reduced neuronal death. Gene expression analysis showed declines in AD-associated biomarkers including Csf1r, Trem2, and Tyrobp. Additionally, mice treated with EI-1071 exhibited enhanced cognitive function in NOR and Y-maze tests. The phase 1 study revealed excellent safety of EI-1071, with all experienced "Treatment Emergent Adverse Events" (TEAEs) in the multiple ascending dose study being grade 1 (by CTCAE V.5), and none related to EI-1071 dosing. These findings indicate that EI-1071 mitigates AD-associated pathologies, particularly reducing neuroinflammation and preserving neuronal functions, and is safe and well-tolerated in humans, making it an attractive candidate for development as a disease-modifying therapeutic for AD or other neurodegenerative diseases involving neuroinflammation.

# IADDS-邀請演講者- Dong-Ming Huang

2024年8月15日 星期四 (13:20-15:20)

*化工系館201*

**Dong-Ming Huang, Associate Investigator**
Current Position
Associate Investigator. Institute of Biomedical Engineering and Nanomedicine, National Health Research Institutes, Taiwan

**Biography Brief**

Dr. Huang's research interests focus on 1) the development of integrated application and new strategy for nanomedicine and stem cell biology, and 2) the development of novel nanocarriers for biomedical applications. His lab is trying to lead the impact of SPIO nanoparticles on stem cell attributes to favorable stem cell therapy and developing a novel system composed of red blood cell-derived vesicles (RDVs) for biomedical applications.

**Selected Publications**

Chih-Peng Lin, Shu-Hui Wu, Tzu-Yin Lin, Chia-Hui Chu, Leu-Wwi Lo, Ching-Chuan Kuo, Jang-Yang Chang, Szu-Chun Hsu, Bor-Sheng Ko, Ming Yao, Jong-Kai Hsiao, Shih-Wei Wang, and Dong-Ming Huang*. Lysosomal-targeted doxorubicin delivery using RBC-derived vesicles to overcome drug-resistant cancer through mitochondrial-dependent cell death. Pharmacological Research. 2023, 197, 106945. (SCI, IF: 9.1 PHARMACOLOGY&PHARMACY 13/354) (Corresponding author)

Shu-Hui Wu, C.-C. Hsieh, Szu-Chun Hsu, Ming Yao, Jong-Kai Hsiao, Shih-Wei Wang, Chih-Peng Lin and Dong-Ming Huang*. RBC-derived vesicles as a systemic delivery system of doxorubicin for lysosomal-mitochondrial axis-improved cancer therapy. Journal of Advanced Research. 2021, 30, 185–196. (SCI, IF: 10.7 MULTIDISCIPLINARY SCIENCES 10/73) (Corresponding author)

# RBC-Derived Vesicles as A Systemic Delivery System of Doxorubicin for Improved and Inoperable Cancer Therapy

**Dong-Ming Huang (黃東明)***

Institute of Biomedical Engineering and Nanomedicine, National Health Research Institutes, Taiwan (國家衛生研究院生醫工程與奈米醫學研究所)
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**ABSTRACT**

Chemotherapy responsible for the main intervention for cancer management is still limited by several drawbacks. Nanoparticles as drug delivery systems (DDSs) show promise to solve these limitations. However, sophisticated design and construction based on xenogeneic nanomaterials are always required for current DDSs, which evokes their feasibility and biocompatibility concerns.

Herein, a simple but versatile biological DDS (bDDS) composed of human red blood cell (RBC)-derived vesicles (RDVs) with excellent biocompatibility and surface-linked with doxorubicin (Dox) using glutaraldehyde (glu) to synthesize Dox-gluRDVs was investigated for improved and inoperable cancer therapy. Our work can not only demonstrate the RDVs as a biocompatible material to improve conventional cancer chemotherapeutics, but also offer a new a new strategy of lysosomal-mitochondrial axis-dependent cancer cell death for the efficient cancer therapeutic. In addition, Dox-gluRDV-mediated lysosomal-mitochondrial axis-dependent cancer cell death could tackle inoperable cancers such as multidrug resistance (MDR) tumors..

**References:**

[1] Lin C-P, Wu S-H, Lin T-Y, Chu C-H, Lo L-W, Kuo C-C, Chang J-Y, Hsu S-C, Ko B-S, Yao M, Hsiao J-K, Wang S-W, Huang DM*. Lysosomal-targeted doxorubicin delivery using RBC-derived vesicles to overcome drug-resistant cancer through mitochondrial-dependent cell death. ***Pharmacological Research.*** 2023;197:106945.

[2] Wu S-H, Hsieh C-C, Hsu S-H, Yao M, Hsiao J-K, Wang S-W, Lin C-P, Huang DM*. RBC-derived vesicles as a systemic delivery system of doxorubicin for lysosomal-mitochondrial axis-improved cancer therapy. ***Journal of Advanced Research.*** 2021;30:185–96.

# IADDS-邀請演講者- Tse-Ying Liu

2024年8月16日 星期五 (10:00-12:00)

*化工系館202*

**Tse-Ying Liu, Professor**

Current Position
Professor, Department of Biomedical Engineering,
National Yang Ming Chiao Tung University

**Biography Brief**

Dr. Tse-Ying Liu received his Ph.D. degree in Materials Science and Engineering from National Chiao-Tung University in 2006. From 1995 to 2002, he served as the Engineer and Manager in the Department of Process Development at Compeq Co., Ltd (a manufacturer of IC substrates and PCBs). In 2008, he joined the Institute of Biomedical Engineering at National Yang Ming University, where he currently serves as a Distinguished Professor and the Department Chair of the Department of Biomedical Engineering at National Yang Ming Chiao Tung University. His main research focus is on utilizing nanomaterials to encapsulate water-insoluble drugs. In recent years, he has concentrated on enhancing the efficacy and reducing the side effects of radiotherapy using nanomaterials. He is also dedicated to proposing solutions for inhibiting cancer metastasis.

**Selected Publications**

1.Yu-Chi Wang, Pei-Wei Shueng, Chan-Yu Hu, Fu-I Tung, Ming-Hong Chen, **T.Y. Liu***. Hyaluronic acid-based injectable formulation developed to mitigate metastasis and radiation-induced skin fibrosis in breast cancer treatment. ***Carbohydrate polymers*** 2024 122126,.

2.Y.C. Wang, S.H Tsai, M.H. Chen, F.Y. Hsieh, Y.C. Chang, F.I. Tung, **T.Y. Liu.***Mineral Nanomedicine to Enhance the Efficacy of Adjuvant Radiotherapy for Treating Osteosarcoma. ***ACS Applied Materials & Interfaces*** 2022; 14, 4: 5586–5597.

3.C.S. Chiang. I.J. Shih, P.W. Shueng, L.W. Kao, S.F. Zhang, M.H. Chen, **T.Y. Liu.*** Tumor cell-targeting radiotherapy in the treatment of glioblastoma multiforme using linear accelerators. ***Acta Biomaterialia*** 2021;125:300-311.

4.F.I. Tung, L.J. Zheng, K.T. Hou, C.S. Chiang, M.H. Chen, **T.Y. Liu.*** One stop radiotherapeutic targeting of primary and distant osteosarcoma to inhibit cancer progression and metastasis using 2DG-grafted graphene quantum dots. ***Nanoscale*** 2020;12(16):8809-8818.

5.C.L. Pan, M.H. Chen, F.I. Tung, **T.Y. Liu.*** A nanovehicle developed for treating deep-seated bacteria via using low-dose X-ray. ***Acta Biomaterialia*** 2017;47:159-169.

6.H.P. Chen, F.I. Tung, M.H. Chen, **T.Y. Liu.*** A magnetic vehicle realized tumor cell-targeted radiotherapy using low-dose radiation. ***Journal of controlled release*** 2016;226:182–192.

# Lanthanide-based Nanomedicines to Enhance the Efficacy of Adjuvant Radiotherapy for Treating Cancer

王毓琦[1], 劉澤英[1*]

[1] 國立陽明交通大學生物醫學工程學系
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**MOST 111-2221-E-A49 -051 -MY2**

**ABSTRACT**

Adjuvant radiotherapy, involving surgical resection followed by radiotherapy, is crucial in cancer treatment as it reduces the risk of locoregional recurrence and improves overall survival by targeting remaining cancer cells post-surgery. However, cancer patients face a critical 2-3 week recovery period post-surgery without active treatment, which increases the risk of recurrence and metastasis. Metastasis is a significant issue in cancer therapy, often leading to poor prognosis and death. To address this, we developed lanthanide-based nanomedicines to mitigate the metastasis risks associated with the post-surgery recovery period.

We first developed europium-doped calcium fluoride ($CaF_2$) nanoparticles (NPs) to enhance the efficacy of adjuvant radiotherapy in osteosarcoma. In vitro and in vivo studies demonstrated that $CaF_2$ NPs selectively targeted osteosarcoma cells (143B), inhibiting their growth and migration when combined with radiotherapy, showing potential as a post-tumor resection treatment..

Additionally, we created an injectable formulation containing europium (Eu) and lanthanum (La) ions crosslinked with hyaluronic acid (HAc) to form HAc-Eu and HAc-La nanosponges for breast cancer treatment. Upon injection, these nanosponges swelled into sub-microscale particles, allowing prolonged retention and controlled ion release. In vitro, HAc-Eu inhibited cell migration and invasion, while HAc-La reduced cell colony formation. Compared to pristine lanthanide compounds, the crosslinked ions exhibited superior efficacy. In vivo studies showed that HAc-Eu nanosponges prevented distant metastasis, and HAc-La nanosponges reduced tumor proliferation, cell spread, and increased survival rates in mice. This approach has the potential to revolutionize post-surgical breast cancer management by addressing the treatment gap during recovery.

**References:**

Yu-Chi Wang, Sheng-han Tsai, Ming-Hong Chen, Fu-Yu Hsieh, Yuan-Chen Chang, Fu-I Tung, and Tse-Ying Liu. Mineral Nanomedicine to Enhance the Efficacy of Adjuvant Radiotherapy for Treating Osteosarcoma. *ACS Applied Materials & Interfaces* 2022 *14* (4), 5586-5597.

# IADDS-邀請演講者- Ching-Hsiang Fan

2024年8月15日 星期四 (13:20-15:20)

*化工系館210*

**Ching-Hsiang Fan, Assistant professor**

Current Position
Assistant professor. Department of Biomedical Engineering,
National Cheng Kung University, Taiwan.

**Biography Brief**

Prof. Fan is currently an Assistant professor at Department of Biomedical Engineering, National Cheng Kung University, Taiwan. His research focuses on designing multi-functional ultrasound responsible drug carrier, transcranial drug delivery, and transcranial neuromodulation. His current research includes neural stem cell acoustic manipulation, peripheral neuromodulation, and transcranial gene delivery. He has contributed to the noninvasive brain tumor treatment and Parkinson' disease treatment. Her research works also involve the development of novel waveform of ultrasound for different therapeutic purposes.

**Selected Publications**

CH Fan, HC Tsai, YS Tsai, HC Wang, YC Lin, PH Chiang, N Wu, MH Chou, YJ Ho, ZH Lin, CK Yeh, Selective Activation of Cells by Piezoelectric Molybdenum Disulfide Nanosheets with Focused Ultrasound, ACS NANO, 17:9140-9154, 2023.

CH Fan, N Wu, CK Yeh, Enhanced sonodynamic therapy by carbon dots-shelled microbubbles with focused ultrasound, Ultrasonics Sonochemistry 94:106342, 2023.

CH Fan, KC Wei, NH Chiu, EC Liao, HC Wang, et al. Sonogenetic-Based Neuromodulation for the Amelioration of Parkinson's Disease, Nano letters 21: 5967-5976, 2021.

WC Lo, CH Fan, YJ Ho, CW Lin, CK Yeh, Tornado-Inspired Acoustic Vortex Tweezer for Trapping and Manipulating Microbubbles, Proc Natl Acad Sci U S A. 118: e2023188118, 2021.

# Combing focused ultrasound and carbon dots-shelled microbubbles enhance sonodynamic therapy

**Ching-Hsiang Fan (范景翔)1, Nan Wu (吳楠)2, Chih-Kuang Yeh (葉秩光)**

1 Department of Biomedical Engineering, National Cheng Kung University, Tainan, Taiwan (國立成功大學生物醫學工程學系)

1 Department of Biomedical Engineering and Environmental Sciences, National Tsing Hua University, Hsinchu, Taiwan (國立清華大學生醫工程與環境科學系)

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ABSTRACT

Sonodynamic therapy (SDT), which involves generating reactive oxygen species (ROS) non-invasively and locally using ultrasound (US) with sonosensitizers, has been proposed as a promising tumor treatment strategy [1]. Nonetheless, this therapy often leads to inertial cavitation, causing unnecessary damage to healthy tissues due to the insufficient sensitivity of current sonosensitizers to US [2]. In this study, we introduce a novel sonosensitizer: carbon dots (C-dots), which are used to create microbubbles with a gas core (C-dots MBs). By incorporating C-dots directly into the MB shell, they can efficiently absorb inertial cavitation energy and convert it into ROS. Our findings show the presence of singlet oxygen (1O2), hydroxyl radicals (•OH), and hydrogen peroxide (H2O2) following US irradiation of C-dots MBs. In vitro studies demonstrated that treatment with C-dots MBs and US led to lipid peroxidation, increased intracellular ROS levels, and induced apoptosis in 32.5%, 45.3%, and 50.1% of cells, respectively. In an animal model with solid tumors, this treatment resulted in a threefold and 2.5-fold increase in ROS-positive and apoptotic cells, respectively, compared to C-dots MBs alone. These results suggest the potential for designing new multifunctional sonosensitizers for effective SDT tumor therapy.

This work was supported by the Ministry of Science and Technology (MOST) of Taiwan, under grants nos. 108-2221-E-007-040-MY3, 108-2221-E-007-041-MY3, 110-2221-E-007-019-MY3, 111-2321-B-002-014, 111-2221-E-007-019-MY3, 108-2638-M-002-001-MY2, and 111-2636-E-006-025.

References:

[1] Son r S, et al. Multifunctional sonosensitizers in sonodynamic cancer therapy, Chemical Society Reviews 2020;49:3244-3261.

[2] Sugita N, et al. Sonodynamically induced cell damage using rose bengal derivative, Anticancer research 2010;30: 3361-3366.

# IADDS-邀請演講者- Chih-Sheng Chiang,

2024年8月16日 星期五 (10:00-12:00)

*化工系館202*

**Chih-Sheng Brian Chiang, Assistant Professor**

Current Position
Assistant Professor. Graduate Institute of Biomedical Sciences,
China Medical University, Taiwan

**Biography Brief**

Dr. Chiang specializes in translational nanomedicine, with a particular focus on cancer treatments. His research delves into the nano-bio interactions, aiming to devise novel strategies for nanomedicine to engage with immune system and the tumor microenvironment, thereby enhancing therapeutic efficacy. Actively involved in academia-industry partnerships, Dr. Chiang has over 10 granted patents and involvement in two technology-transfer processes and is dedicated to offering innovative and translational solutions to address unmet medical needs. Notably, his nanomedicine product, INSP003, a polysaccharidic docetaxel, has garnered acceptance for development under the 505(b)(2) regulatory pathway by the FDA. He is presently driving the development process forward to expedite entry into clinical trials, with the ultimate aim of improving patients' quality of life.

**Selected Publications**

1.Lai Y-H, Su C-Y, Cheng H-W, Chu C-Y, **Chiang C-S***, Shyu W-C and Chen S-Y, Stem cell–nanomedicine system as a theranostic bio-gadolinium agent for targeted neutron capture cancer therap. ***Nature Communications***, 2023; 14 (1), 285 (**IF 2022: 16.6**; Multidisciplinary Sciences 7/134)

**2.Chiang C-S**, Shih I-J, Shueng P-W, Kao M, Chang L-W, Chen S-F, Chen M-H and Liu T-Y, Tumor cell-targeting radiotherapy in the treatment of glioblastoma multiforme using linear accelerators. ***Acta Biomaterialia***. 2021; 125, 300-311 (**IF 2022: 9.7**; Engineering, Biomedical 9/96)

**Chiang C-S**, Lin Y-J, Lee R, Lai Y-H, Cheng H-W, Hsieh C-H, et al. Combination of fucoidan-based magnetic nanoparticles and immunomodulators enhances tumour-localized immunotherapy. ***Nature Nanotechnology***. 2018; 13, 746–54 (**IF 2022: 38.3**; Nanoscience & Nanotechnology 2/108)

# Therapeutic fucoidan nanoparticles: from combination immunotherapy and advanced cell delivery to translational nanomedicine

**W-Lee (李瑋)[1], Y-H Lai (賴彥合)[1], L-B Jeng (鄭隆賓)[1], S-Y Chen (陳三元)[2], W-C Shyu (徐偉成)[1,3] and C-S Chiang (江智聖)[1,3*]**

[1] Cell Therapy Center, CMUH (中國醫藥大學附設醫院細胞治療中心);
[2] Department of Materials Science and Engineering, NYCU (國立陽明交通大學材料科學與工程學系);
[3] Graduate Institute of Biological Medicine, CMU (中國醫藥大學生物醫學研究所)

E-mail: brian.chiang@mail.cmu.edu.tw

**ABSTRACT**

Our team has developed fucoidan-based nanoparticle (FuNP) capable of targeting tumor, alleviating tumor progression, activating immune system, and modulating the tumor immune microenvironment (TIME), demonstrating the translational potential for drug delivery and cancer vaccination. By coupling with the immunomodulators, inorganic nanoparticles, targeting moieties or chemotherapeutics, FuNP is allowed to realize theragnostic application [1]. In an example, FuNP immobilized with anti-CD3 and anti-CD28 as well as anti-PD-L1 demonstrated the ability to achieve simultaneously tumor-site-specific T cell proliferation and checkpoints inhibition. We have also demonstrated that FuNP might modulate TIME by interrupting the crosstalk between immune and cancer cells and promoting DC maturation/ NK cell activation. In another attempt, by strategically integrating cells and FuNP, we create a living stem cell-nanoparticle system (SNS) that possesses the advantages from both sides. Specifically, gadolinium-loaded FuNP was intracellularly delivered to stem cells to form SNS for neutron capture therapy (NCT). SNS possesses the nature of stem cell to penetrate blood-brain barrier (BBB) and fuses with brain tumor, while FuNP can stably encapsulate gadolinium to alleviate the cytotoxicity toward stem cells. SNS facilitates the effective tumor homing effect, presenting a high tumor-blood ratio and tumor-normal-tissue ratio at the brain tumor, and eliminating the glioblastoma multiform (GBM) to prolong survival while limiting the systemic adverse effect [2]. Lastly, to solve the unmet medical need of toxicity dilemma for the marketed chemotherapeutics docetaxel (DTX), our team has been focusing on translating INSP003, the DTX-encapsulated FuNP with enhanced therapeutic index. INSP003 has been accepted by FDA to be developed under 505(b)(2), ensuring the faster clinical translation with lower risks. The strategy of using natural compound such as fucoidan to form inherently therapeutic nanoparticle potentially paving an avenue for the development of a new family of nanomedicines for advanced tumor therapy.

**References:**

[1] **C. S. Chiang**, Y. J. Lin, R. Lee, Y. H. Lai, H. W. Cheng, C. H. Hsieh, W. C. Shyu, S. Y. Chen, Combination of fucoidan-based magnetic nanoparticles and immunomodulators enhances tumour-localized immunotherapy. Nature Nanotechnology, 13, 746–54 (2018)

[2] Y. H. Lai, C. Y. Su, H. W. Cheng, C. Y. Chu, L.B. Jeng, **C. S. Chiang***, W. C. Shyu, S. Y. Chen, Stem cell–nanomedicine system as a theranostic bio-gadolinium agent for targeted neutron capture cancer therapy. *Nature Communications*, 14(1), 285 (2023)

# IADDS-邀請演講者- Ming-Fa Hsieh

2024年8月16日 星期五 (10:00-12:00)

*化工系館202*

**Dr. Ming-Fa Hsieh**
Professor, Department of Biomedical Engineering,
Chung Yuan Christian University (CYCU)
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**Research Profile**

Dr. Hsieh has been working on applied biomaterials research in various institutions. In his early research career, he studied the sol-gel chemistry of calcium phosphate and developed hydroxyapatite coating for orthopedic and dental implants at National Tsing-Hua University. After working as a researcher at the Industrial Technology Research Institute, he devoted himself to drug delivery systems, including polymeric micelles for cancer therapy. Afterward, he was appointed to an academic position at Chung Yuan Christian University, where he established a biomaterials lab for orthopedic biomaterials, cancer nanomedicine, transdermal delivery, and related topics. His recent interests are biomaterials for cartilage repair and liposome formulation for Parkinson's disease. His lab is experienced with synthetic and natural agents to combat inflammatory syndromes. Similarly, the therapeutic effect of stem cells on inflammatory intestines in mice is also investigated.

**Selected Publications**

MF Hsieh, LH Perng, TS Chin*, HQ Perng, "Phase purity of sol-gel-derived hydroxyapatite ceramic", Biomaterials, 22, 2601-2607 (2001).

CH Chen, MF Hsieh*, YN Ho, CM Huang, JS Lee, CY Yang, Y Chang, "Enhancement of Catechin Skin Permeation via a Newly Fabricated mPEG-PCL-graft-2-hydroxycellulose Membrane", J. Membrane Sci., 371, 134-140 (2011).

NV Cuong, YL Li, MF Hsieh*, "Targeted Delivery of Doxorubicin to Human Breast Cancers by Folate-Decorated Star-Shaped PEG-PCL Micelle", J. Mater. Chem., 22, 1006-1020 (2012).

YL Chang, HY Lo, SP Cheng, KT Chang, XF Lin, SP Lee, MF Hsieh*, CK Chan*, "Therapeutic Effects of a Single Injection of Human Umbilical Mesenchymal Stem Cells on Acute and Chronic Colitis in Mice", Scientific Reports, 9(1), 5832 (2019).

L. Barro, JT Hsiao, CY Chen, YL Chang, and MF Hsieh*. "Cytoprotective Effect of Liposomal Puerarin on High Glucose-Induced Injury in Rat Mesangial Cells", Antioxidants, 10, (8), 1177 (2021).

YH Hsieh, YC Chu, JT Hsiao, YT Shu, HM Lee, MF Hsieh*, "Porcine Platelet Lysate Intra-articular Knee Joint Injections for the Treatment of Rabbit Cartilage Lesions and Osteoarthritis", Journal of Biological and Medical Engineering, 43, 102-111 (2023).

# Porcine Platelet Lysate for Cartilage Repair and Wound Healing

**Min Teng Low (盧明登)[1,2], Yi-Ho Hsieh (謝義禾)[1,2], Ming-Fa Hsieh (謝明發)[1*],**
[1] Department of Biomedical Engineering, Chung Yuan Christian University (中原大學醫工系)
[2] Department of Orthopedics, Min-Sheng General Hospital (敏盛醫院骨科部)
E-mail: mfhsieh@cycu.edu.tw

**ABSTRACT**

Autologous platelet-derived therapy, such as platelet-rich plasma, has been widely used in the clinic. Platelet lysates, prepared by removing blood cells and other antigens from platelet-rich plasma, contain various growth factors that endow anti-inflammatory and regenerative potential to the recipients. The present abstract reports two porcine platelet lysate (pPL) research topics for the *in vivo* applications of cartilage defects and skin wounds. In the rabbit cartilage defects, the tissue sections in the knee joints showed no inflammatory reaction (Fig.1, left). Histological cross-sections showed that the articular cartilages had undifferentiated hyaline cartilage, a thin layer of undifferentiated hyaline cartilage, and fibrocartilage, respectively. Topical application of pPL in mouse skin wounds significantly expedited the wound healing. The histological cross-sections demonstrated enhanced re-epithelialization and increased granulation tissue in the wounds treated with pPL. A newly formed epidermal layer was exclusively observed in the pPL-treated wounds (Fig. 1, right).

Platelet Lysate plays a vital role in tissue regeneration by releasing growth factors like PDGF, VEGF, and TGF-β. PDGF stimulates the migration of immune cells, contributing to re-epithelization and angiogenesis. VEGF supports neurogenesis and new blood vessel formation, while TGF-β1 plays a role in the inflammatory process.

Our study demonstrates the potential use of pPL in cartilage repair and wound healing. However, further research is needed to validate and implement xenogeneic platelet lysate in clinical therapies.

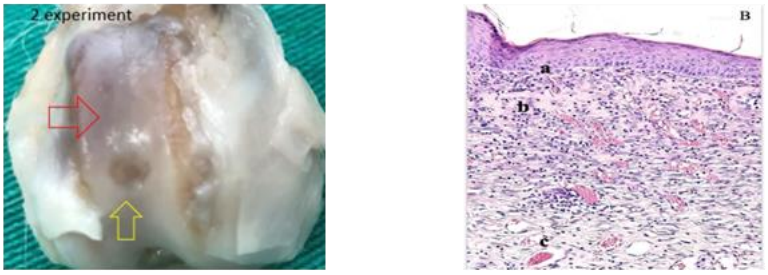



Figure 1. (Left) 75% of the rabbit osteochondral defect had newly-formed cartilage (yellow arrow), and the articular surface was smooth, indicating no sign of degeneration (red arrow). (Right) the mouse skin wound treated by pPL showed re-epithelialization (a), granulation tissue (b), and capillaries in the wounds (c).

Acknowledgments: The authors would like to thank the National Science and Technology Council (MOST 110–2221-E-033–004-MY2) and Min-Sheng General Hospital for their financial support.

References:

[1] Hsieh, YH., Chu, YC., Hsiao, JT. et al. Porcine Platelet Lysate Intra-articular Knee Joint Injections for the Treatment of Rabbit Cartilage Lesions and Osteoarthritis. J. Med. Biol. Eng. 43, 102–111 (2023).

# IADDS-邀請演講者- Guo-Chung Dong

2024年8月15日 星期四(15:40-17:10)

*化工系館210*

**Guo-Chung Dong 董國忠**

Current Position

| | |
|---|---|
| 1997/09 – 2002/06 | **Ph.D.**, Institute of Chemistry, Dept. Chem., Chung Yuan Christian University, Taiwan |
| 1995/09 – 1997/06 | **Master**, Institute of Chemistry, Dept. Chem., Chung Yuan Christian University, Taiwan |
| 1991/09 – 1995/06 | **Bachelor**, Dept. Chem. Eng., Yuan Ze University, Taiwan |

**Biography**

The research training of Guo-Chong Dong is mainly in the fields of chemistry, biomedical materials, and tissue engineering. Afterward, in year of 2009, he joined the Medical Engineering Division of the National Health Research Institutes as an assistant investigator and established a **protein and tissue engineering laboratory**. The main research direction is "**clinical translation of bone tissue engineering** ". Over the past 15 years, Dr. Dong has insisted on using protein engineering as a strategy to develop the structural properties of tissue engineered bone. His team has successively completed technologies such as BMP-2 patterning, natural BMP-regulated molecules, and designed BMP-2 peptides. Respectively, his team achieved regional bone differentiation, regulating the balance between BMPR-1a and BMPR-1b, guiding the combination of BMP-2 and BMPR-1b to help **tissue engineered bones to form bone–like intra-structure.** Recently, in response to the national medical mission, he has embarked on research on personalized medicine of cancer and in vitro simulation of cancer bone metastasis. His team has completed in-vitro culture of breast cancer to form **large tissue**, bone structure to promote **tumor tissue calcification**, and pancreatic cancer tissue **resistant to drug infiltration**.

**Selected Publications**

1.Dong, G.-C.*, A Tumor Accelerator Based on Multicomponent Bone Scaffolds and Cancer Cell Homing. Polymers 2022, 14(16), 3340-3354. IF2020 = 4.329

2.Dong, G. C.*, A Cyclic BMP-2 Peptide Upregulates BMP-2 Protein-Induced Cell Signaling in Myogenic Cells. Polymers 2021, 13 (15), 2549-2559. IF2020 = 4.329

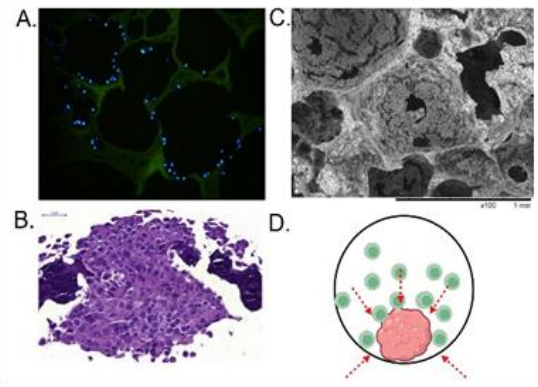
3.Dong, G. C.*, A study of Drynaria fortunei in modulation of BMP-2 signaling by bone tissue engineering. Turk J Med Sci 2020, 50 (5), 1444-1453. IF2020 = 0.973

# From bone regeneration to bone metastasis: Controllable Bone micro-environments to model the progression of metastatic cancers

**Guo-Chung Dong (董國忠)[1*]**
[1] Institute of Biomedical Engineering & Nanomedicine, National Health Research Institutes
(國家衛生研究院 醫學工程與奈米醫學所)
E-mail: gcdong@nhri.org.tw

**ABSTRACT**

Cancer is also an important cause of bone trauma. In addition to tissue engineering to reconstruct bones after tumor removal surgery, the development of in vitro bone metastasis models is another important contribution of tissue engineering. In this research, protein immobilization within the bone scaffold is an approach to control various bone microenvironments, such as bone protein types, bone protein density, bone protein degradation rate, degraded calcium and bone hardness, etc., to produce various bone scaffolds. Then, metastatic cancer cells are planted on various scaffolds, and with the help of bioreactors, they are cultured for 28 days to observe the three-dimensional growth, tumor formation, calcification, etc. of the metastatic cells. The results show that immobilized EGF and other proteins can accelerate the three-dimensional growth of cancer cells and form ECM-rich tumor tissue, which can reach a diameter of 3 mm. BMP-2 and bone hardness show that tumor tissue is mineralized. This in vitro bone metastasis model has completed a large number of sample tests and can currently test 60 samples simultaneously. This model was used to measure the infiltration ability of EGFR-targeted drugs and CART cells into tumors. Results showed that the concentration required to inhibit tumors is much higher than the IC50 concentration of 2D, and is very close to the literature animal experiments. This shows that this bone metastasis model has naturally formed drug resistance. In addition to being used as an alternative to animal experiments, it will also be developed into personal cancer treatment in the future, with unlimited prospects.




**References:**

•Dong, G.-C.*, A Tumor Accelerator Based on Multicomponent Bone Scaffolds and Cancer Cell Homing. Polymers 2022, 14(16), 3340-3354. IF2022 = 5.0

•Dong, G. C.*, A Cyclic BMP-2 Peptide Upregulates BMP-2 Protein-Induced Cell Signaling in Myogenic Cells. Polymers 2021, 13 (15), 2549-2559. IF2022 = 5.0

# IADDS-邀請演講者- Sheng-Sheng Yu

2024年8月15日 星期四 (15:40-17:10)

*化工系館210*

**Sheng-Sheng Yu, Associate Professor**

Current Position
Associate Professor. Department of Chemical Engineering, National Cheng Kung University, Taiwan
Academic Qualifications
•Ph.D. in School of Chemical & Biomolecular Engineering, Georgia Institute of Technology, Atlanta, USA (08/2012 – 05/2017)
•B.S. in Department of Chemical Engineering, National Tsing-Hua University, Hsinchu, Taiwan (09/2007 – 06/2011)

**Biography Brief**

Sheng-Sheng Yu received his B.S. from National Tsing-Hua University in 2011, before moving to Georgia Tech to pursue his Ph.D. in Chemical and Biomolecular Engineering (2017). After a short postdoc at University of California, Berkeley, he began a faculty position at National Cheng Kung University in the Department of Chemical Engineering (now, Associate Professor). His research group focuses on developing green and sustainable processes for polymeric materials. For instance, he has utilized alternative solvents to facilitate peptide bond formation and photo-induced controlled radical polymerization. Moreover, he employed bio-based materials such as cellulose for additive manufacturing of functional nanocomposite.

**Selected Publications**

Huang, C.-W.; Wen, S. -C.; Yu, S.-S.* Self-healable, Digital Light Processing of Soft Robotic Gripper with High Toughness and Self-Healing Capability Achieved by Deep Eutectic Solvents. Advanced Functional Materials, 2024, https://doi.org/10.1002/adfm.202314101 (SCI, IF 19.0, 8/178, Chemistry, Multidisciplinary)

Ren, Z. -F.; Lin, K. -Y; Yu, S.-S.,* The Effect of Temperature and Shear on the Gelation of Cellulose Nanocrystals in Deep Eutectic Solvents. Biomacromolecules, 2024, 25 (1), 248-257. (SCI, IF 6.2, 3/52, Chemistry, Organic)

Lai, P.-C.; Ren, Z.-F.; Yu, S.-S.,* Thermally Induced Gelation of Cellulose Nanocrystals in Deep Eutectic Solvents for 3D Printable and Self-healable Ionogels. ACS Applied Polymer Materials, 2022, 4 (12), 9221-9230. (SCI, IF: 5.0, 16/86, Polymer Science)

Li, C. -Y.; Yu, S.-S.,* Efficient Visible-Light-Driven RAFT Polymerization Mediated by Deep Eutectic Solvents under an Open-to-Air Environment. Macromolecules 2021, 54 (21), 9825-9836. (SCI, IF 5.5. 11/86, Polymer Science)

# Additive Manufacturing of Polymer gels for Wearable Ionotronics and Soft Robotics

**Sheng-Sheng Yu (游聲盛)**[1,2,3*]

[1] Department of Chemical Engineering, National Cheng Kung University, Tainan, Taiwan (國立成功大學化學工程學系)

[2] Core Facility Center, National Cheng Kung University, Tainan, Taiwan (國立成功大學核心設施中心)

[3] Academy of Innovative Semiconductor and Sustainable Manufacturing, National Cheng Kung University, Tainan, Taiwan (國立成功大學智慧半導體及永續製造學院)

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**MOST 110-2222-E-006-009-MY3**

**ABSTRACT**

Soft ionotronics with self-healing capability and tough mechanical properties are highly desirable for wearable sensors that monitor physiological signals. Rapid prototyping by 3D printing further expands new design spaces to enhance the performance of wearable sensors. However, it remains a challenge to simultaneously achieve printability, mechanical toughness, and self-healing capability. Here, we demonstrate a simple route to 3D printable ionogels by thermal-induced gelation of cellulose nanocrystals (CNCs) in a deep eutectic solvent (DES). Our strategy significantly reduces the concentration of CNCs needed to prepare printable inks for direct ink writing (DIW). Further photopolymerization of monomers in the composite inks leads to ionogels containing multiple dynamic bonding types. The ionogels can then be printed as triangular lattice structures to increase the sensitivity of wearable sensors. We also introduce resins based on DES to fabricate a pneumatically driven soft gripper using digital light processing (DLP). By utilizing the intense hydrogen bonding within DES, the resin can be rapidly cured by photopolymerization to form tough ionogels without chemical crosslinkers. The DES ionogels exhibit remarkable toughness and self-healing performance compared to common hydrogels. Furthermore, the ionogels show efficient energy-dissipating behavior and achieve rapid self-recovery. Finally, the DLP-printed soft gripper from the DES-based resin successfully actuates and heals macroscopic damages. Overall, our work presents a simple strategy to 3D print wearable sensors and soft robotic grippers with high toughness and self-healing capability.

# IADDS-邀請演講者- Ching-Li Tseng

2024年8月16日 星期五 (08:45-09:45)

*化工系館202*

**Ching-Li Tseng, Professor**

Current Position

Professor, Graduate Institute of Biomedical Materials and Tissue Engineering, Taipei Medical University

**Biography Brief**

The research focus of Prof. Tseng is biomaterials application in drug delivery and tissue repair. Especially in non-invasive way to deliver nanomedicine for disease treatment, for example inhalation of nanomedicine for treating lung cancer/fibrosis, and nanoparticles contained eye-drops for ophthalmic disease treatment. She continuously works on the specific drug/gene delivery system in ophthalmology to find an effectively and friendly way to treat eye disease for clinic application such as dry eye syndrome, corneal/choroidal neovascularization, and blue light damage treatment.

**Selected Publications**

1.YC Chu, HW Fang, YY Wu, YJ Tang, EH Hsieh, YZ She, CY Chang, IC Lin, YJ Chen, GS Liu, **CL Tseng***. Functional peptide-loaded gelatin nanoparticles as eyedrops for cornea neovascularization treatment. ***International Journal of Nanomedicine***, ***2023***.18, 1413-1431. (SCI, IF: 8.000, Pharmacology & pharmacy, 17/278 ) (corresponding)

2.JH Wang[+], **CL Tseng**[+], FL Lin, JY Chen, EH Hsieh, S Lama, YF Chuang, S Kumar, L Zhu, MY McGuinness, J Hernandez, L Tu, PY Wang, GS Liu[*]. Topical application of TAK1 inhibitor encapsulated by gelatin particle alleviates corneal neovascularization. ***Theranostics. 2021*** (12):657-674. (SCI, IF:12.400, Medicine, Research & Experimental 8/136 ) (co-first author)

HY Huang, MC Wang, ZY Chen, WY Chiu, KH Chen, IC Lin, WCV Yang, CC Wu, **CL Tseng***
Gelatin/epigallocatechin gallate nanoparticles with hyaluronic acid decoration as eye drops can treat rabbit's dry eye syndrome effectively via inflammatory relief. ***International Journal of Nanomedicine***. 2018, (13):7251-7273. (SCI, IF: 8.000, Pharmacology & pharmacy, 17/278 ) (corresponding)

# 玻尿酸修飾奈米藥物應用於藍光誘導損傷之小鼠視網膜病變治療

# Hyaluronic acid surface-modified nanomedicine for the treatment of retinopathy in mice with blue light-induced damage

**Yan-Zhen Li[1] (李彥蓁)[1], Ching-Li Tseng(曾靖嬭)[1*]**

[1] Graduate Institute of Biomedical Materials and Tissue Engineering, Taipei Medical University (臺北醫學大學 生醫材料暨組織工程研究所)

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Blue light (BL) can't be filtered by the cornea and lens which can directly reaching retina. People rely on smartphones daily; with long time BL contact, it's high risk to cause BL retinal damages which associated with ROS increase and inflammation. The transforming growth factor-β activated kinase-1inhibitor (TAK-1I), 5Z-7-Oxozeaenol(Oxo), can decrease ROS, inhibit inflammation/angiogenesis, was chosen as the therapeutic agent for treating retinal BL damages. Ocular drug delivery (DD) faces many biological barriers affecting DD and therapeutic efficacy. To address this issue, nanomedicine, with targeting capacity and control release ability are favored for posterior eye treatment. The gelatin and hyaluronic acid (HA) were adopted as the raw components for particles preparation since its native in eyes. With HA modification to recognize CD44 receptor on retinal epithelial cells (RPE), this nanomedicine can help DD to retina for BL damage treatment.

When HA modified gelatin nanoparticles (GNP) were loaded with Oxo, its size (HA GNP-Oxo) and z-potential were about 166 nm, and -30 mV. The drug encapsulated rat was ~80%. The slow drug release pattern was observed in the HA GNP-Oxo group. For the *in vitro* test, ARPE-19 used for cell viability test showed that cell viability of HA GNP-Oxo still had > 70% at Oxo concern. of 100 ng/ml. For the BL damaged mice model, the fundus fluorescein angiography (FFA) revealed fundus plaques and vessel leakage at day 3 after BL irradiation. The coherence tomography (OCT) images revealed that the boundary of the outer retinal nuclear layer (ONL) in the BL damaged retina became clear, and the thickness of the ONL was back to normal after HA GNP-Oxo treatment via intravitreal injection. Electroretinogram (ERG) result also revealed b wave recovery at day 7.

The nanomedicine, HA GNP-Oxo, was successfully prepared, and it can relief the damages of cells after BL irradiation via inhibiting the ROS formation. The *in vivo* BL retinal damage mice model was established, and the therapeutic effect of HA GNP-Oxo was also proofed via recover the ONL thickness and vision function confirmed by FFA, OCT and ERG tests. This nanomedicine has potential for apply in BL induced retinopathy treatment in the future.

**References:**

[1] Chan YJ, Hsiao G, Wan WN, et al. Blue light exposure collapses the inner blood-retinal barrier by accelerating endothelial CLDN5 degradation through the disturbance of GNAZ and the activation of ADAM17. Fluids Barriers CNS 2023; 20:31.1-16.

# IADDS-邀請演講者- Y-Jung Lin

2024年8月16日 星期五 (10:00-12:00)

*化工系館210*

**Y-Jung Lin, Assistant Research Fellow**

Current Position
Assistant Research Fellow, Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan

**Biography Brief**

Dr. Yu-Jung Lin is currently an Assistant Research Fellow at the Research Center for Applied Sciences, Academia Sinica. She received her PhD degree from the Department and Institute of Physiology at National Yang-Ming University in 2014. Her doctoral dissertation focused on the pathophysiological roles of pulmonary sensory nerves. In 2015, Dr. Lin joined Prof. Hsing-Wen Sung's lab at NTHU as a Postdoctoral Fellow. During her post-doctoral training, she specialized in designing and preparing various bubble-evolving systems, such as nitric oxide and molecular hydrogen, aimed at treating different diseases. Since joining Academia Sinica in 2020, Dr. Lin's research interests have centered on the development of cold- and thermal-mimetic compound delivery systems for advanced healthcare. Additionally, inspired by the potential of H2 energy, she dedicates her efforts to fabricating numerous H2-evolving systems using hydrogen fuel materials for therapeutic applications.

**Selected Publications**

Ngo, T. L. H., Wang, K. L., Pan, W. Y., Ruan, T.*, Lin, Y. J.* Immunomodulatory prodrug micelles imitate mild heat effects to reshape tumor microenvironment for enhanced cancer immunotherapy. ACS Nano 2024, 18, 5632–5646. (SCI, IF: 17.1, Materials science, multidisciplinary 20/344)

Ruan, T., Fu, C. Y., Lin, C. H., Chou, K. C., Lin, Y. J.* Nanocontroller-mediated dissolving hydrogel that can sustainably release cold-mimetic menthol to induce adipocyte browning for treating obesity and its related metabolic disorders. Biomaterials 2023, 297, 122120. (SCI, IF: 14, Engineering, biomedical 4/97)

Wu, C. Y., Mac, C. H., Yang, T. H., Nguyen, K., Lo, S. K., Chang, Y., Lai, P. L., Sung, H. W.*, Lin, Y. J.* Nanoscale photocatalytic hydrogen production system mitigates inflammation by harnessing glycolysis waste. Chem. Eng. J. 2023, 476, 146614. (SCI, IF: 15.1, Engineering, chemical 5/143)

# Mild Heat-Mimicking Immunomodulatory Micelles for Reprogramming Tumor Microenvironment

**Yu-Jung Lin (林鈺容)[1*], Ting Ruan (阮婷)[2], Thi-Lan-Huong Ngo (吳氏蘭香)[1], Kuan-Lin Wang (王冠麟), Wen-Yu Pan (潘玟伃)[3]**

[1] Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan (中央研究院應用科學研究中心), [2] School of Medicine, Fu Jen Catholic University, New Taipei City, Taiwan (輔仁大學醫學系), [3] *School of Medical Laboratory Science and Biotechnology, College of Medical Science and Technology, Taipei Medical University, Taipei, Taiwan* (台北醫學大學醫學檢驗暨生物技術學系所)

E-mail: linyujung@gate.sinica.edu.tw

**ABSTRACT**

The immunosuppressive tumor microenvironment (TME) hinders the effectiveness of immune checkpoint inhibitor (ICI) therapies. Research suggests that mild heat can alter the TME, potentially activating transient receptor potential vanilloid 1 (TRPV1) channels and fostering an immune-responsive environment. This study introduces a novel method to chemically mimic the immunomodulatory effects of mild heat using a glutathione (GSH)-responsive prodrug micelle system. These micelles deliver capsaicin, a TRPV1 activator, alongside BMS202, an ICI. The micelles preferentially localize in the TME via the enhanced permeability and retention effect. Once in the GSH-rich TME, the micelles disassemble, releasing their therapeutic cargo. Capsaicin may activate TRPV1, increasing PD-L1 expression on tumor cells and enhancing T cell infiltration, thereby making the TME more immune-active. Simultaneously, BMS202 inhibits PD-1/PD-L1 interactions, further stimulating T cells. This strategy leverages the TRPV1 pathway to achieve precise in situ immunomodulation within the TME, significantly boosting the effectiveness of cancer immunotherapy by mimicking the beneficial effects of mild heat without external thermal application.

**References:**

1. Ngo TLH, Wang KL, Pan WY, Ruan T, Lin YJ. Immunomodulatory prodrug micelles imitate mild heat effects to reshape tumor microenvironment for enhanced cancer immunotherapy. ACS Nano 2024;18:5632–5646.

2. Huang L, Li Y, Du Y, Zhang Y, Wang X, Ding Y, Yang X, Meng F, Tu J, Luo L, Sun C. Mild photothermal therapy potentiates anti-PD-L1 treatment for immunologically cold tumors via an all-in-one and all-in-control strategy. Nat. Commun. 2019, 10, 4871.

# IADDS-邀請演講者- Tzu-Wei Wang

2024年8月16日 星期五 (10:00-12:00)

*化工系館210*

**Tzu-Wei Wang, Professor**

Current Position
Professor. Department of Materials Science and Engineering,
National Tsing Hua University, Taiwan

**Biography Brief**

Dr. Wang' s research interests are: 1) Development of functionalized smart biomaterials for the applications in tissue engineering and drug delivery; 2) Control of extracellular microenvironment using physical, chemical, and biological approaches for the manipulation of stem cell fate. He has published over 50 scientific peer-reviewed SCI papers (h index 30, i10 index 42) and received several international patents in the past few years. He has been awarded with *Young Investigator Awards* in the field of Biomaterials and Tissue Engineering *including TERMIS Young Plenary Award and IUMRS Frontier Materials Young Scientists Award.* He also received *Research Scholar Award* and *Biomedical Engineering Award* for his research studies and contribution in the Biomaterials and Controlled Release Society, Taiwan.

**Selected Publications**

1. Liu YC, Chen SH, Kuan CH, Chen SH, Huang WY, Chen HX, **Wang TW***. Assembly of Interfacial Polyelectrolyte Complexation Fibers with Mineralization Gradient for Physiologically-inspired Ligament Regeneration. *Advanced Materials 2024 :e2314294*
2. Lee CH, Huang WY, Lee KY, Kuan CH, Wu TC, Sun JS, **Wang TW***. Bioinspired Adhesive Nanofibrous Hydrogel Promotes Immune Infiltration through Effective Immunochemotherapy for Osteosarcoma Treatment. *Chemical Engineering Journal 2024;486 :150236*

# Bioinspired Adhesive Nanofibrous Hydrogel Promotes Immune Infiltration through Effective Immunochemotherapy for Osteosarcoma Treatment

**Tzu-Wei Wang (王子威))[1*]**

[1] Department of Materials Science and Engineering, National Tsing Hua University, Hsinchu, Taiwan

(國立清華大學 材料科學與工程學系)

E-mail: twwang@mx.nthu.edu.tw

**MOST 111-2628-B-007 -005 -MY3**

Osteosarcoma, the predominant primary malignant bone tumor, presents ongoing clinical challenges, notably in local recurrence and metastasis. Here, we introduce a nanofibrous hydrogel composed of two layers, a bottom layer consisting of catechol-functionalized gelatin hydrogel and a top layer made up of hyaluronic acid (HA) / polycaprolactone (PCL) electrospun nanofiber matrix, for dealing with bone malignancy. This nanofibrous hydrogel incorporates doxorubicin (DOX), a primary chemotherapeutic agent, followed by the release of immune-related cytokines, thereby initiating an immunotherapeutic response to target residual malignancy. Our results demonstrate that this hydrogel can conformally adhere to bone tumor sites, enabling localized treatment and reducing systemic toxicity. The anti-cancer efficacy is notably augmented through DOX-mediated cytotoxicity and the induction of immunogenic cell death, which stimulates immune cell recruitment to the tumor milieu. Exploiting the distinct degradation kinetics of HA and PCL nanofibers, we achieve a controlled and sequential liberation of IFN-γ and IL-12, thereby amplifying the immunological anti-cancer effects. *In vivo* assessments reveal that our nanofibrous hydrogel significantly enhances T-cell activation, facilitates lymphocyte infiltration into tumor tissue, and effectively suppresses tumor growth. This nanofibrous hydrogel demonstrates substantial potential as a drug delivery system in osteosarcoma treatment, offering a synergistic approach to immunochemotherapy applicable to various cancer types.

**References:**

[1]. Lee CH, Huang WY, Lee KY, Kuan CH, Wu TC, Sun JS, **Wang TW***. Bioinspired Adhesive Nanofibrous Hydrogel Promotes Immune Infiltration through Effective Immunochemotherapy for Osteosarcoma Treatment. *Chemical Engineering Journal 2024;486 :150236*

# IADDS-邀請演講者- Ho-Hsiu Chou

2024年8月16日 星期五 (08:45-09:45)

*化工系館210*

**Ho-Hsiu Chou, Professor**

Current Position
Professor. Department of Chemical Engineering, National Tsing Hua University, Taiwan

**Biography Brief**

Prof. Ho-Hsiu Chou is a Full Professor in the Department of Chemical Engineering at National Tsing Hua University. His primary research emphasis lies in functional polymers and the influence of molecular engineering on their properties and interfacial phenomena. Within five years, Chou has published over 45 SCI journals as the corresponding authors. Over half of these journals with high impact factors (23 papers: IF > 10; 15 papers: IF > 15), and nearly half of these publications are ranking within the top 5% in the field of chemical engineering or material science.

**Selected Publications**

1.H.-H. Chou *et al.*, "Fluoro-based organic small molecules as sliding crosslinkers for boosting stretchability and self-healability of polymers for hybrid human-motion sensing and energy harvesting" ***Nano Energy,*** 2023, 117, 108882 (IF=17,6) (Front cover)

2.H.-H. Chou *et al.*, "Autonomously self-healing and ultrafast highly-stretching recoverable polymer through trans-octahedral metal-ligand coordination for skin-inspired tactile sensing" ***Chem. Eng. J.***, 2022, 438, 135592 (IF=15.1)

3.H.-H. Chou *et al.*, "Disulfide bond and Diels–Alder reaction bond hybrid polymers with high stretchability, transparency, recyclability, and intrinsic dual healability for skin-like tactile sensing" ***J. Mater. Chem. A***, 2021, 9, 6109-6116 (IF= 11.9)

H.-H. Chou *et al.*, "Entirely, Intrinsically, and Autonomously Self-healable, Highly Transparent, and Super-Stretchable Triboelectric Nanogenerator for Personal Power Sources and Self-Powered Electronic Skins" ***Adv. Funct. Mater.***, 2019, 29, 197027 (IF=19.0) (VIP & Cover)

# Development of Conjugated Polymer Nanoparticles with NIR-II Fluorescence and Photocatalytic Hydrogen Production for *In Situ* Hydrogen-Photothermal Therapy of Glioblastoma

**Ying-Rang Zhuang (莊英讓)[1], Ho-Hsiu Chou (周鶴修)[1*]**

[1] Department of Chemical Engineering, National Tsing Hua University (化學工程學系)
E-mail: hhchou@mx.nthu.edu.tw

**NSTC 112-2221-E-007-081-**
**NSTC 112-2223-E-007-006-MY3**

**ABSTRACT**

Glioblastoma (GBM) is the most aggressive form of malignant brain tumor. Due to its high recurrence rate, traditional treatments such as surgery and chemotherapy are quite limited in their efficacy against GBM. Developing novel imaging diagnostics and precise treatment methods for GBM is crucial for improving patients' quality of life and extending their survival time. To achieve this goal, we propose a near-infrared II region (NIR-II) fluorescent imaging in situ photocatalytic hydrogen production combined with photothermal therapy for GBM.

In this study, we utilized a dual-receptor molecular design to develop a conjugated polymer with NIR-II absorption and NIR-IIb emission. By adjusting the ratio between the two receptors, the absorption peak of the conjugated polymer was red-shifted from NIR-I to NIR-II, balancing the competitive dynamics between radiative decay-induced 1500 nm near-infrared fluorescence imaging and non-radiative decay-induced near-infrared photothermal therapy. The results show that the nanoparticles developed in this study can observe the vascular distribution within mice through a 1500 nm long-pass filter, maintaining good resolution and excellent signal-to-noise ratio. Additionally, these nanoparticles exhibit good photothermal efficiency, heating up to over 42 degrees Celsius under near-infrared irradiation.

In summary, this study developed a theragnostic approach within the NIR-II window, paving a new pathway for the treatment of glioblastoma.

**References:**

[1] Liu, Y., et al., Photothermal therapy and photoacoustic imaging via nanotheranostics in fighting cancer. Chemical Society Reviews, 2019. 48(7): p. 2053-2108.

[2] Li, J. and K. Pu, Development of organic semiconducting materials for deep-tissue optical imaging, phototherapy and photoactivation. Chemical Society Reviews, 2019. 48(1): p. 38-71.

[3] Wang, J., et al., Brain-Targeted Aggregation-Induced-Emission Nanoparticles with Near-Infrared Imaging at 1550 nm Boosts Orthotopic Glioblastoma Theranostics. Advanced Materials, 2022. 34(5): p. 2106082.

# IADDS-邀請演講者- Shih-Ting Wang

2024年8月16日 星期五 (08:45-09:45)

*化工系館210*

**Shih-Ting (Christine) Wang, Ludwig Postdoctoral Fellow**

Current Position
Adjunct Assistant Professor and incoming Assistant Professor, Department of Materials Science and Engineering, Northwestern University, IL, USA
Ludwig Postdoctoral Fellow, Koch Institute of Integrative Cancer Research, Massachusetts Institute of Technology, MA, USA

**Biography Brief**

Dr. Wang is an incoming tenure-track assistant professor at the Department of Materials Science and Engineering, Northwestern University. She is currently a postdoctoral fellow at the Koch Institute of MIT. Her research focuses on the development of novel biomaterials with well-defined sequence, structure, and properties that can interface and interact with biological systems. Her current research develops clinically translatable nano-sensors for cancer and infection. Specifically, she has contributed to the development synthetic breath biomarkers for non-invasive assessment of disease microenvironments via exhaled breath. Her future laboratory will develop enabling materials for understanding of chemical and biological mechanisms of various pathophysiological processes.

**Selected Publications**

1.C. Martin-Alonso, S. Tabrizi, K. Xiong, T. Blewett, S. Sridhar, A. Crnjac, S. Patel, Z. An, A. Bekdemir, D. Shea, S. -T. Wang, S. Rodriguez-Aponte, C. A. Naranjo, J. Rhoades, J. Kirkpatrick, H. Fleming, A. Amini, T. R. Golub, J. C. Love, S. N. Bhatia, V. A. Adalsteinsson. Priming agents improve in vivo recovery of cell-free DNA and enhance the sensitivity of liquid biopsies. Science 2024. 383, 6680.

2.S. -T. Wang, B. Minevich, J. Liu, H. Zhang, D. Nykypanchuk, W. Liu, J. Byrnes, L. Bershadsky, Q. Liu, T. Wang, G. Ren, O. Gang. Designed and Biologically Active Protein Lattices. Nature Communications. 2021. 12: 3702 3. S. -T. Wang, M. A. Gray, S. Xuan, Y. Lin, A. I. Nguyen, N. Todorova, M. M. Stevens, C. R. Bertozzi, R. N. Zuckermann, O. Gang. DNA Origami Protection and Molecular Interfacing through Engineered Sequence-Defined Peptoids. Proceedings of the National Academy of Sciences. 2020. 117, 6339–6348

## Engineering Orthogonal Breath Biomarkers for Multiplexed Cancer Diagnostics

S. -T. Wang, D. M. Kim, M. Anahtar, C. S. Wang, T. S. Samad, C. M. Zheng, C. Ngambenjawong, H. Ko, S. Patel, J. Kirkpatrick, V. Kumar, H. Fleming, S. N. Bhatia.

Breath testing is a fast, non-invasive diagnostic method that can link specific volatile organic compounds (VOCs) in exhaled breath to medical conditions. Complementary to blood and urine assays in clinical disease diagnosis, breath is an informative analyte that can provide real-time information of changes in the body's metabolome affected by disease activity. However, relatively few breath tests are currently used in the clinic due to ongoing challenges in identifying disease-specific endogenous VOCs in complex breath signatures and limited reproducibility. One approach to overcome this challenge is the administration of orthogonal exogenous agents with controlled properties that can be expelled from breath upon being metabolized by disease-specific molecular processes. Here, we leverage the diverse changes in enzymatic activities during tumor progression to develop synthetic breath biomarkers for the detection of lung cancer. Specifically, we design multiplexed volatile releasing activity-based nanosensors (vABNs) that can sense broad catalytic types of proteases and generate cognate exogenous volatile reporters in the exhaled breath. Using an autochthonous mouse model of *Alk*-mutant lung cancer, our multiplexed vABNs together with machine learning enable monitoring of tumor progression and treatment response within 30 min with >80% accuracy. This diagnostic accuracy can be further enhanced by multiplexing with select endogenous VOCs. We demonstrate a multianalyte diagnostic approach for breath analysis which can be amenable to various pathophysiological processes and for point-of-care diagnostics.

# Competition

# Young Investigator Competition (YIC)
# Oral Competition
# Poster Competition

# Young Investigator Competition (YIC)

| 日期: 2024 年 8 月 15　　地點:化工系館 220 | | |
|---|---|---|
| 時間 | 發表人 | 論文題目 |
| **13:20-13:30** | 朱麗安 | Reveal treatment efficiency with whole organ multiplex cellular level imaging technologies. |
| **13:30-13:40** | 程華強 | Monocyte-Mediated Drug Carriers for Delivering Therapeutics that Target Chronic Diseases |
| **13:40-13:50** | 程吉安 | Before Translating Extracellular Vesicles into Personalized Diagnostics and Therapeutics: What We Could Do |
| **13:50-14:00** | 何慈娟 | Improving progression of aging related neurodegenerative diseases: Development and Evaluation of neuroprotective factor A-loaded Lactic-co-glycolic acid nanoparticle |
| **14:00-14:10** | 江銘仁 | Mitochondrial Targeting and Wireless Charging Enhanced Gene Delivery by Porous Nanogold for Leber Hereditary Optic Neuropathy Treatment |
| **14:10-14:20** | 徐于懿 | Development of dynamic-crosslinked nanocomposite hydrogel sensors with efficiency self-healing and adhesion properties |
| **14:20-14:30** | 熊彥傑 | Amphiphilic NLC-Gel Formulation Loaded with Sebacoyl Dinalbuphine Ester and Nalbuphine for Localized Postoperative Pain Management |
| **14:30-14:45** | break | |
| **14:45-14:55** | 陳民樺 | Enhancing cancer radiation therapy with hafnium-doped bioceramic nanoparticles |
| **14:55-15:05** | 林鈺容 | Obesity Management: Remodeling Obese Adipose Tissue Microenvironment with Advanced Drug Delivery Systems |
| **15:05-15:15** | 賴千蕙 | Monocyte-Mediated Drug Carriers for Delivering Therapeutics that Target Chronic Diseases |
| **15:15-15:25** | 穆宣佑 | Glyco-modified Interfaces in the Application of Anti-cancer Drug Delivery or Bio-Sensing |
| **15:25-15:35** | Yen-Hong Lin | Enhanced extracellular vesicle production via biofabrication of auxetic hydrogels combine cyclic force stimulation |
| **15:35-15:45** | 李亦宸 | Integrating Biointerfaces with Computational Technologies for the Cell Culture Applications |
| **15:45-15:55** | 許如秀 | Topical application of 15-PGDH inhibitor encapsulated by nanomicelle rescues vision loss in animal model anterior ischemic optic neuropathy |

# Oral Competition

## 學生口頭競賽 I

| 日期: 2024 年 8 月 15　時間: 13:40~15:10　地點:化工系館 209 | | | |
|---|---|---|---|
| 發表編號 | 論文編號 | 發表人 | 論文題目 |
| OD-01 | 051 | 余祐陞 | Downsizing and Functionalization of Interpenetrated Metal–Organic Frameworks for Combined Photothermal and Radiation Cancer Therapy |
| OD-02 | 025 | 林朕楷 | Dual targeting nanoparticles for in situ cancer vaccine |
| OD-03 | 023 | 張英偉 | Development of self-amplifying (saRNA) system for Combination Cancer Therapy |
| OD-04 | 019 | Kandel Manoj | Copper Selenide Nanoparticles for Colorectal Cancer Therapy: H2S Scavenging, In Vivo Band Gap Modulation, and Improved Photothermal and Chemodynamic Effects |
| OD-05 | 015 | Quinones Edgar | Three-dimensionally cultured adipose derived stem cell exosomes for diabetic wound healing |
| OD-06 | 009 | 許思椁 | Development of sperminated hyaluronan-functionalized ceria nanocarriers for drug delivery |
| OD-07 | 008 | 楊佳蓉 | Polyhistidine-mediated therapeutic delivery of roughened ceria nanocapsules for treatment of ocular alkali burn |
| OD-08 | 004 | Ta Yen-Nhi | A pH-sensitive nanoparticles enables efficient delivery of glucose oxidase and apoptosis-based anti-cancer agents for effective cancer therapy in Hepatocellular Carcinoma |
| OD-09 | 036 | Tran Linh | Construction of PVA/PGCL multi-layered nanofibrous patch for controlled release of diclofenac sodium in aphthous ulcer |

## 學生口頭競賽 II

| 日期: 2024 年 8 月 15　時間: 15:30~17:00　地點: 化工系館 209 | | | |
|---|---|---|---|
| 發表編號 | 論文編號 | 發表人 | 論文題目 |
| OE-01 | 048 | 周訓宏 | A Multi-functional Self-powered System ba<x>sed on Harvesting Mechanical and Electromagnetic Energy for Accelerating Wound Healing |
| OE-02 | 047 | 詹凱閔 | Oxygen-generating FeMoSe nanocomposites mediate self-reinforced cascade reactions for enhanced cancer chemodynamic / immunotherapy |
| OE-03 | 045 | 陳新和 | Development of ferulic acid-PNIPAM-gelatin-based hydrogel with thermal and reactive oxygen species responsive properties as a cell carrier for hind limb ischemia treatment |
| OE-04 | 039 | 楊俐婷 | Photo-Responsive Ascorbic Acid-Modified Ag2S–ZnS Heteronanostructure Dropping pH to Trigger Synergistic Antibacterial and Bohr Effects for Accelerating Infected Wound Healing |
| OE-05 | 028 | 鄭博修 | Iron-Based Metal−Organic Framework MIL-100(Fe) Regulates Fibrosis in Keloid Scarring |
| OE-06 | 017 | 黃瑋 | 3D Printed Intervertebral Cage Loaded with Simvastatin:Enhancing Bone Cell Growth and Stability in Spinal Fusion |
| OE-07 | 010 | 潘琬淇 | Wireless magnetoelectric-driven Gene Therapy Targeting miR6236 Downregulation-mediated by Conductive Porous Hydrogel for Nerve Regeneration after Traumatic Brain Injury |
| OE-08 | 016 | 陳品諺 | Developing Pseudovirus-like Nanoparticle To Package RNA For Bone Regeneration |
| OE-09 | 018 | 鄭聖良 | An Anti-cancer Hydrogel-Based In-Situ Vaccination via Durable and Effective STING Activation |

## 學生口頭競賽 III

| 日期: 2024 年 8 月 16　時間: 8:45~10:15　地點:化工系館 220 | | | |
|---|---|---|---|
| 發表編號 | 論文編號 | 發表人 | 論文題目 |
| OC-01 | 052 | 陳朗兒 | Development of Therapeutic Exosomes Targeting Osteoarthritis: A Proof-of-concept Study in Rat Osteoarthritis Model |
| OC-02 | 050 | 林言叡 | Application of Piezoelectric Poly-L-Lactic Acid in Treating Spinal Epidural Compression |
| OC-03 | 049 | 林巧旻 | Ex Vivo Tumor-Microenvironment-on-Chip for Drug Screening: Combining Epigenetic Modulation with Immunotherapy |
| OC-04 | 044 | 簡丞邦 | Trigger-Responsive Peptidyl Liposome as Smart MRI Contrast Agent for Disease Detection |
| OC-05 | 033 | Shie Ming-You | Li-doped calcium silicate scaffold regulate macrophage-derived extracellular vesicles for immunomodulation and regeneration |
| OC-06 | 037 | 張廷瑋 | Preparation and application of bioinks for 3D bioprinting of breast cancer metastasis chip |
| OC-07 | 007 | Mac Cam-Hoa | Orally Ingestible Piezoelectric Particulate Stimulators for Noninvasive Vagus Nerve Stimulation in Treating Obesity and Sepsis |
| OC-08 | 010 | 黃靖文 | Bio-inspired radiative cooling aerogel for sustainable cold preservation |
| OC-09 | 040 | 郭珈菱 | Rapid Identification of Nanoplastics via Ultrasensitive Surface-Enhanced Raman Scattering (SERS) Detection for Food Safety |

# Poster Competition

## 免疫治療

| 日期：2024 年 08 月 15 日 | | | 時間：13:30–15:00 | 地點：化工館一樓中庭 |
|---|---|---|---|---|
| 發表編號 | 論文編號 | 發表人 | 論文題目 | |
| PA-01 | 044 | 陳梧熏 | Development of Novel Therapeutic Strategies for Triple-Negative Breast Cancer: Preparation and Application of a Temperature-Sensitive Hydrogel for Triple Combination Therapy | |
| PA-02 | 030 | 王丹靜 | 次世代基因藥物遞送之銅單原子催化劑奈米粒子應用於高效標靶肺臟免疫治療 | |

## 穿戴式感測

| 日期：2024 年 08 月 15 日 | | | 時間：13:30–15:00 | 地點：化工館一樓中庭 |
|---|---|---|---|---|
| 發表編號 | 論文編號 | 發表人 | 論文題目 | |
| PB-01 | 008 | Putry Yosefa Siboro | Harnessing HfO2 Nanoparticles for Wearable Tumor Monitoring and Sonodynamic Therapy in Advancing Cancer Care | |
| PB-02 | 004 | 莊顗平 | Detection of the Analytes in Sweat with Organic Field-effect Transistor for Non-invasive Analysis | |

## 精準醫療

| 日期：2024 年 08 月 15 日 | | | 時間：13:30–15:00 | 地點：化工館一樓中庭 |
|---|---|---|---|---|
| 發表編號 | 論文編號 | 發表人 | 論文題目 | |
| PC-01 | 083 | 駱雨利 | Precision Nanoformulation for Cancer Treatment: pH-Responsive Coating with ER Stress Inducers and MicroRNA | |
| PC-02 | 060 | 蔡威霆 | A Novel Approach: Neutralized DNA (nDNA) Antisense Oligonucleotides for miRNA Silencing in Cancer Therapy | |
| PC-03 | 053 | 王梓華 | A High-Throughput Organ-on-Chip Platform for Personalized Drug Screening in Oncocardiology: Focusing on Tumor-Induced Arrhythmias | |
| PC-04 | 047 | 陳彥良 | A Simple Method to Produce NIR Photothermal Responses of Polypyrrole-Polydopamine-Silk Fibroin Conductive Hydrogels for Wound Healing Applications | |
| PC-05 | 029 | 陳宇良 | Enhancing Photothermal-Thrombolysis using Fibrin-Targeted GCREKA Decorated Pd@MIL-100 Nanoparticles: Synthesis and Application | |
| PC-06 | 023 | 藍元宏 | 天然草本與新型衍伸物結合壁虎仿生微柱：精準用於皮膚美白與修復抗發炎的應用 | |
| PC-07 | 012 | 林峻璋 | A Conformable, Antioxidative, Self-healable Electrically Conductive Hydrogel Electrodes for Improved Physiological Signal Monitoring | |

**Drug delivery**

| 日期：2024 年 08 月 15 日 | | | 時間：13:30–15:00 | 地點：化工館一樓中庭 |
|---|---|---|---|---|
| 發表編號 | 論文編號 | 發表人 | 論文題目 | |
| PD-01 | 084 | 劉瑋文 | Ultrasound-assisted Delivery of Cisplatin-loaded Chitosan Nanoparticles for Enhanced Tumor Therapy | |
| PD-02 | 079 | 范舒媛 | Design of Hydrogen-Producing Nanoparticles with Positive Charge for Targeting Visceral Fat in Obesity Treatment | |
| PD-03 | 078 | 陳韋廷 | 可緩釋米諾地爾與薑黃素之植入式雙效型微針應用於雄性禿之治療 | |
| PD-04 | 109 | 王吉烽 | Enhancing controlled drug release: Heat sealing the broken ends of coaxial electrospun fibers to mitigate initial burst release | |
| PD-05 | 066 | 胡哲綸 | Dual-Drug Delivery Microneedle Patch for Gout Relief | |
| PD-06 | 106 | 楊仁端 | Developing an universal influenza mRNA vaccine on a microneedle | |
| PD-07 | 063 | Ritwick Ranjan Sarma | Tumor targeting and blood-brain barrier infiltrating synergistic nanotheranostics for glioblastoma treatment | |
| PD-08 | 104 | 陳蘋欣 | Producing and Engineering Pseudovirus-like Nanoparticles for RNA Self-packaging and Delivery | |
| PD-09 | 062 | 蔡曜恩 | 探討白鮮鹼奈米藥物應用於異位性皮膚炎組織再生之研究 | |
| PD-10 | 059 | 陳姿涵 | Development of Nanoparticle Loaded Microneedle Mediated Gene Delivery on the Application of Cancer Treatment | |
| PD-11 | 058 | 何佳哲 | Exosome derived from pulmonary differentiated induced pluripotent stem cells for amelioration of idiopathic pulmonary fibrosis | |
| PD-12 | 055 | Ngoc-Tri Tran | Boosting glucose starvation-dominated and photo-immunotherapy through TiO2/graphene oxide/CuS heterojunction nanosheet for oral squamous cell carcinoma eradication | |
| PD-13 | 111 | 何一正 | Nanoparticles of Chitosan/Betaine/Wheat Germ Agglutinin for Enhanced Drug Delivery | |

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|---|---|---|---|
| PD-14 | 052 | 陳佩蓁 | 氫鍵有機框架(HOF)包覆平板鐵攜帶釕化合物協同一氧化氮應用於口腔癌免疫治療與預防淋巴轉移 |
| PD-15 | 086 | 陳品妤 | 載有喜樹鹼之環境敏感性嵌段共聚物/幾丁聚醣/褐藻醣膠奈米粒用於標靶肺癌治療 |
| PD-16 | 089 | 汪祐廷 | Biotin Recognition Multifunctional Nanocarriers Loaded with Dual Drugs for Enhanced Chemotherapy and Immunotherapy |
| PD-17 | 041 | 石芯瑀 | 具模擬細胞膜共聚物包覆 FeN4 單原子粒子應用於增強光催化動力效應於滲透腦瘤免疫治療 |
| PD-18 | 090 | 江柔蒨 | Targeted Delivery of CXCR4 Antagonists via Nanoparticles: Transforming the Tumor Microenvironment to Improve Immunotherapy in Hepatocellular Carcinoma |
| PD-19 | 040 | 張云瑄 | Oral-Delivered Carbon Monoxide-Mediated by Titanium Carbide Nanosheets to Eliminate ROS and Inhibit Macrophage Polarization for Treating Inflammatory Bowel Disease |
| PD-20 | 038 | 王靖雯 | Synthesis and characterization of a novel drug carrier containing phenylboronic acid via RAFT for nucleic acid drug delivery |
| PD-21 | 036 | 林哲暐 | A Skin-Conformal Doubly Crosslinked Microgel-Based Electrode with Precisely Programmable Electrically-Controlled Drug Delivery to Accelerate Diabetic Wound Healing |
| PD-22 | 110 | 丁詩庭 | 以包覆靛氰綠及微生物胞體之聚乳酸-聚甘醇酸奈米粒子用於大腸癌光免疫治療之研究 |
| PD-23 | 035 | Le Ngoc Hoang | Real-Time Monitoring of Contrast-Enhancing Nanoparticles in Eyes Using Biocompatible Metal Halide Perovskites and Optical Coherence Tomography |
| PD-25 | 033 | 蕭掄元 | Tumor-targeted delivery of hyaluronic acid/polydopamine-coated Fe2+-doped nanoMOFs with doxorubicin payload for glutathione depletion-amplified chemodynamic-chemo cancer therapy |
| PD-26 | 028 | 玉雪梅 | Effervescence-Induced In Situ Nanoemulsion Formation for Enhanced Oral Targeted Chemotherapy and Immunotherapy: Impact of Absorption Route |
| PD-27 | 091 | 張晏瑄 | Hyaluronic Acid-Covered Ferric Ion-Rich Nanobullets with High Zoledronic Acid Payload for Breast Tumor-Targeted Chemo/Chemodynamic Therapy |

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| PD-28 | 113 | 黃芷儀 | Development of Peptide-Conjugated Nanoparticle for Enhancing Immunogene Therapy in Pancreatic Cancer |
| PD-29 | 027 | Chung Yu-Kuo | Neutrophil-targeted combinatorial nanosystems for treating bacteremia-associated inflammation and MRSA infection |
| PD-30 | 092 | 熊佳悅 | Development of Intestine-Targeted Nanoparticle for Inflammatory Bowel Disease Therapy |
| PD-31 | 026 | 周冠妤 | 開發包覆喜樹鹼與靛氰綠之全氟碳外泌體用於大腸癌標靶光化學治療之研究 |
| PD-32 | 021 | 劉至翰 | 可經皮緩釋雙重活性成分之雙邊型微針應用於雄性禿之治療 |
| PD-33 | 016 | 李玉琦 | A Strategy of Targeted Nanoparticles and Ultrasound Technology to Enhance Therapy for Drug-Resistant Triple-Negative Breast Cancer |
| PD-34 | 011 | 黃浩綸 | Utilizing Nanoparticles to Enhance Therapeutic Efficacy and Mitigate the Impact of Di(2-Ethylhexyl) Phthalate (DEHP) on Gastric Cancer |
| PD-35 | 025 | 李隆翔 | Synthesis of functionalized mesoporous silica nanoparticle as drug delivery carrier for therapeutic agents. |
| PD-36 | 007 | 高敦翔 | 開發最適合傳遞甘草酸胺鹽到肝臟的藥物傳遞系統 用以治療藥物性肝損傷 |
| PD-37 | 102 | 于政平 | Delivery of calcium and OVA loaded chitosan nanoparticles for dendritic cell cross-presentation |
| PD-38 | 006 | 林于婷 | Electrospun copolypeptide scaffolds as controlled drug delivery systems |
| PD-39 | 010 | 陳東隆 | Understanding the Pharmaceutical Eutectics: Measurement of Binary Solid-Liquid Equilibrium of Urea with p-Toluenesulfonamide or Salicylamide |
| PD-40 | 003 | 鄭翔祐 | Exosome coated MIL-100(Fe) for keloid therapy |
| PD-41 | 002 | 翁在萱 | Application of MIL-100(Fe) Nanoparticle Localized Bi-Layer Dissolving Microneedle Patch for Skin Fibrosis Therapy |
| PD-42 | 001 | 陳彥璋 | HA Functionalized GNR@MIL-100(Fe) for the Photothermal Therapy of Keloid Scars |

## 生醫材料

| 日期：2024 年 08 月 16 日 | | | 時間：09:45-11:15　　地點：化工館一樓中庭 |
|---|---|---|---|
| 發表編號 | 論文編號 | 發表人 | 論文題目 |
| PE-01 | 096 | 游芝蓉 | Behaviors of Micelles and Thermal Gels of PBL-PEG/Laponite Nanocomposites |
| PE-02 | 094 | 陶若云 | Effects of Lecithin on Micellization and Gelation of Amphiphilic Block Copolymers |
| PE-03 | 095 | 張俊埼 | 以新型製備方法之血清白蛋白奈米粒子裝載氯硝柳胺應用於癌症治療 |
| PE-04 | 088 | 林弘旻 | Aerosol Delivery of Nanomedicine for Treating Lung Fibrosis |
| PE-05 | 097 | 邱仲毅 | 皮膚模型之熱傳性質探討 |
| PE-06 | 085 | 陳兆威 | Development of Carbonized Polyphenol Nanoparticles Loaded with Sunitinib as a Novel Anti-Angiogenic Agent for Treating Corneal Neovascularization |
| PE-07 | 082 | 洪小鈞 | Enhanced Disulfiram Treatment Against Colorectal Cancer Through A Tumor Microenvironment-Responsive Copper Selenide Nanoplatform |
| PE-08 | 081 | 鍾佑宣 | Efficient reactive nitrogen species generation mediated by FeSe-based chemodynamic action |
| PE-09 | 080 | 沈家同 | Development and Applications of Conductive Silk Fibroin-based Bioink for 3D Bioprinting |
| PE-10 | 077 | 張淨雯 | Current status of real-time biomedical analysis through surface plasmon resonance single particle detection |
| PE-11 | 076 | 陳祐霖 | Sequential Management of Burn Wound Healing Stages through Biointelligence-Inspired Platelet Extracellular Vesicle-Encapsulated Photodynamic Diferuloylmethane |
| PE-12 | 087 | 曾郁雯 | 透過卡拉膠水凝膠包覆二硫化鉬奈米片運用光療技術來實現牙齒美白的效果 |
| PE-13 | 075 | 蕭淇紘 | 衣藻負載乙二醇殼聚醣-聚吡咯奈米粒子用作免疫調控及光熱療法之膀胱癌治療 |
| PE-14 | 074 | Shie Ming-You | Modulation of Inflammatory and Osteogenic Gene Expression for Bone Regeneration Using Astragalus-Calcium Silicate/Poly-ε-Caprolactone Scaffolds |

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| PE-15 | 073 | 邱宜棻 | Machine Learning Integrated Platform for Applications in Cell Culture |
| PE-16 | 072 | 王鈴惠 | Combination of Chitosan-based Substrate and Computational Model for Patterning the Cell Distribution |
| PE-17 | 071 | 何思儀 | Innovative Drug Evaluation of Gemcitabine and Erlotinib in with EGF Rich Model |
| PE-18 | 070 | 李妍洲 | The spatial benefits of capillary phenomena on the three-dimensional stacking of tumor cells |
| PE-19 | 108 | 李柏廷 | 製備自癒性幾丁聚醣/二氧化矽複合水膠以包裹人類間葉幹細胞 |
| PE-20 | 069 | 張瑄 | Development of a Self-Powered Composite Hydrogel with Rice Husk Biomass for Myocardial Patch Applications |
| PE-21 | 107 | Shie Ming-You | Harnessing the multifunctional of modified-adipose-derived stem cell-derived extracellular vesicles for accelerating healing of diabetic chronic wounds |
| PE-22 | 068 | 楊欣霓 | Preparation and Characterization of Hyaluronic Acid-Drugs Tip Layer of Dissolving Microneedles |
| PE-23 | 105 | 陳澔霖 | UV-Curable Zwitterionic Coatings on Surfaces |
| PE-24 | 065 | Wei-Yung Huang | Wearable Nanozyme-Engineered Chlorella Hydrogels as an Anti-Keloid Phototherapeutic by Augmenting a Hypoxia Microenvironment and Immune and Biological Responses |
| PE-25 | 061 | 姚少凌 | Surface modification of aligned electrospun poly(3-hydroxybutyrate-co-3-hydroxyvalerate)-based scaffold for binding with extracellular matrix in vascular tissue engineering |
| PE-26 | 098 | 趙 本秀 | Nano- and Micro-Scale Topographical Regulation of Osteogenesis |
| PE-27 | 057 | 葉宥君 | Development of conductive bio-ink and its application in 3D bioprinting for neural tissue engineering |
| PE-28 | 056 | 彭俐瑩 | Preparation and Application of Double-Crosslinked High-Strength Hydrogels in Vascular Organ Chips: Establishment and Investigation of Atherosclerosis Models |
| PE-29 | 054 | 邱凱雯 | Enhanced Recovery of Traumatic Brain Injury via Injectable Gelatin Hydrogel Microspheres with DOTAP for Nerve Repair |

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| PE-30 | 049 | 張芸瑄 | 具無線充電基因藥物遞送之多孔奈米金應用視神經萎縮症 |
| PE-31 | 048 | 謝李毅 | Natural Djulis Extracts as Anti-Inflammatory Agents for Early Macular Degeneration Treatment |
| PE-32 | 046 | 劉秀晴 | AdMSC-derived Exosomes Laden Hydrogen-releasing Double-layer Microspheres Improve Traumatic Brain Injury Recovery |
| PE-33 | 067 | 唐碩亨 | 摻雜聚吡咯的細菌纖維素/幾丁聚醣薄膜之抗菌與物化性質以應用在糖尿病大鼠的傷口修復功效 |
| PE-34 | 043 | 李家賢 | Preparation of Poly(γ-benzyl-L-glutamate) self-assembled fibers hydrogel for 3D printing of the cornea |
| PE-35 | 042 | 吳芷瑜 | Controlled Nitric Oxide Release via Ceria MOF-Loaded Microneedle Patch to Induce Immunogenic Cell Death in Cancer Therapy |
| PE-36 | 103 | 劉明鑫 | NIR-activated organic molecule-based nanocomposites with photothermal and photodynamic effects for cancer treatment |
| PE-37 | 099 | 盧子威 | Development of rapid formation genipin cross-linked kind chitosan hemostasis hydrogels |
| PE-38 | 037 | 程姿雅 | Biodisintegratable Furosemide-Loaded Hydrogel ECoG Electrodes with Synchronic Electrically-Controlled Chemical and Physical Treatment of Epilepsy |
| PE-39 | 034 | 魏逸承 | 利用超順磁奈米鐵粒子探針抓菌，並以奈米金粒子顯色 |
| PE-40 | 039 | 孫暐程 | Study on the Application of Iron Nanoparticles Grafted with Bacteriophages for the Detection of Escherichia coli O157 and Staphylococcus aureus |
| PE-41 | 100 | 楊涵雯 | Development and Application of Brain-on-a-Chip for Parkinson's Disease modelling |
| PE-42 | 032 | Dien Thi My Nguyen | Noninvasive Vagus Nerve Electrical Stimulation for Immune Modulation in Sepsis Therapy |
| PE-43 | 101 | 白清華 | Composite Conductive Hydrogel for Neuron Regeneration Treatment of Traumatic Brain Injury |
| PE-44 | 112 | 張鈞評 | 探討幾丁聚醣奈米鐵粒子接枝不同濃度噬菌體之接枝效率與抓菌變化 |

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|---|---|---|---|
| PE-45 | 022 | 葉芊芊 | Long-Term and Effective Stimulation of Collagen Regeneration Using PLLA Microparticle-Loaded Microneedles |
| PE-46 | 050 | Phuc-Thien-Ngan | Continuous Formation of Highly Uniform Liquid-Core Microsphere Using Divalent Cation Substitution |
| PE-47 | 020 | 梁泳怡 | Utilizing Honokiol Loaded In MCM-41 For The Treatment Of Testicular Fibrosis |
| PE-48 | 019 | 黃詩宸 | Transplantation of MSC spheroids alleviates post-TBI excitotoxicity and promotes brain regeneration |
| PE-49 | 018 | 李芃瑩 | Development of a nerve guidance conduit with hydrogelated mesenchymal stem cell for peripheral nerve regeneration |
| PE-50 | 024 | 金修儀 | Development and Analysis of Micro-Nanoparticles from Decellularized Porcine Lung Extracellular Matrix |
| PE-51 | 015 | 王亭芮 | Development of Thermoresponsive Hydrogel Equipped with Antibacterial and Cell Growth-Promoting Functions for Cellulitis Wound Healing |
| PE-52 | 014 | 張家綸 | Development of cell sorting biomaterials: Purification of hiPSC-derived cardiomyocytes |
| PE-53 | 013 | 洪聆鈞 | Purification of Colon Cancer Cells Using Membrane Filtration Method via Modified Porous Polymeric Membranes |
| PE-54 | 017 | 白文哲 | Reducing The Aggregation Of Aβ-Cu In The Brain Using CQ@UiO-66(Ce) |
| PE-55 | 005 | 袁晟榛 | A photoluminescent hydrogel with stretchable and self-healing properties for bacterial detection |
| PE-56 | 064 | 李柏廷 | 製備自癒性幾丁聚醣/二氧化矽複合水膠以包裹人類間葉幹細胞 |